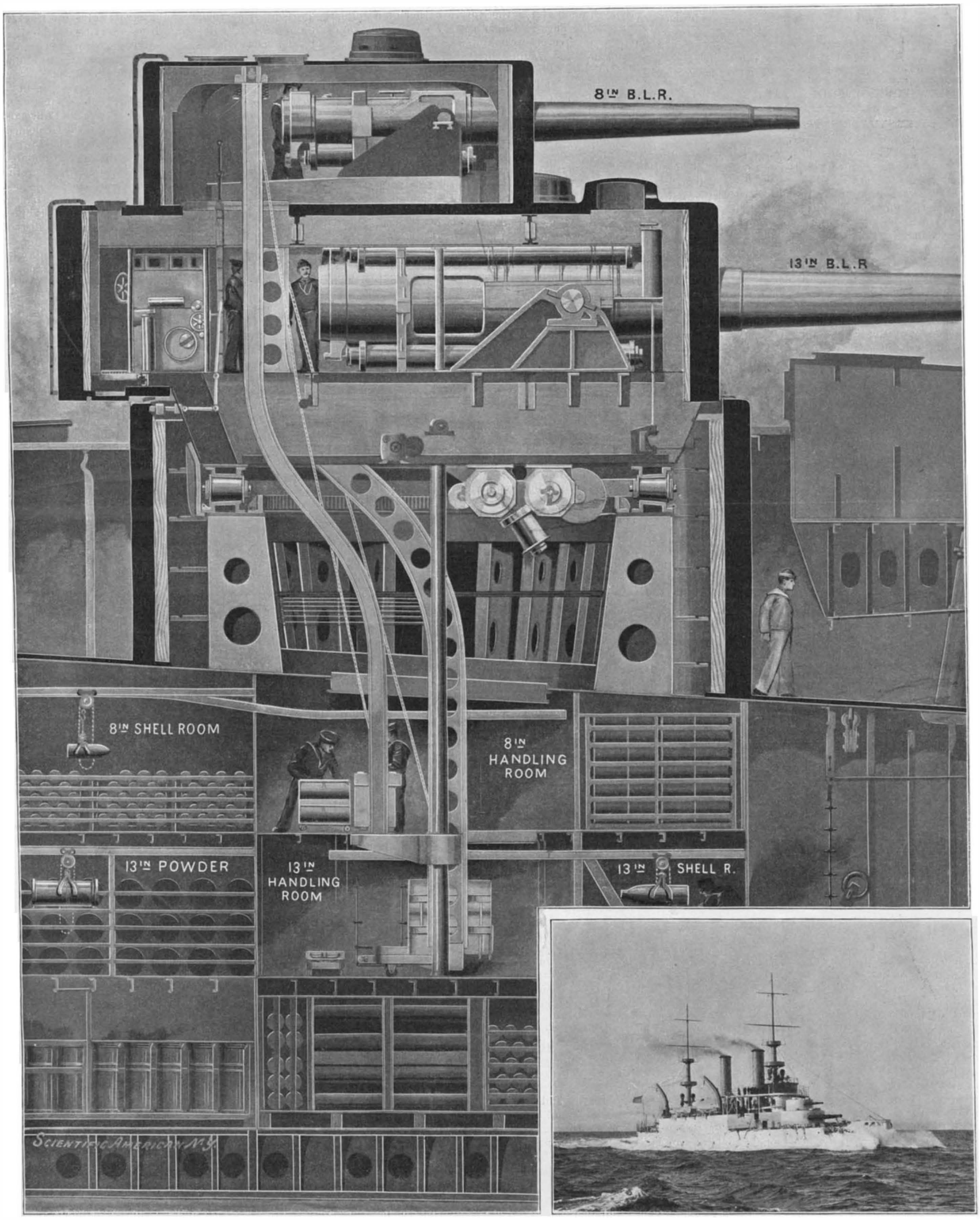
SCIENTIFIC AMERICAN

[Entered at the Post Office of New York, N. Y., as Second Class Matter. Copyright, 1900, by Munn & Co.]

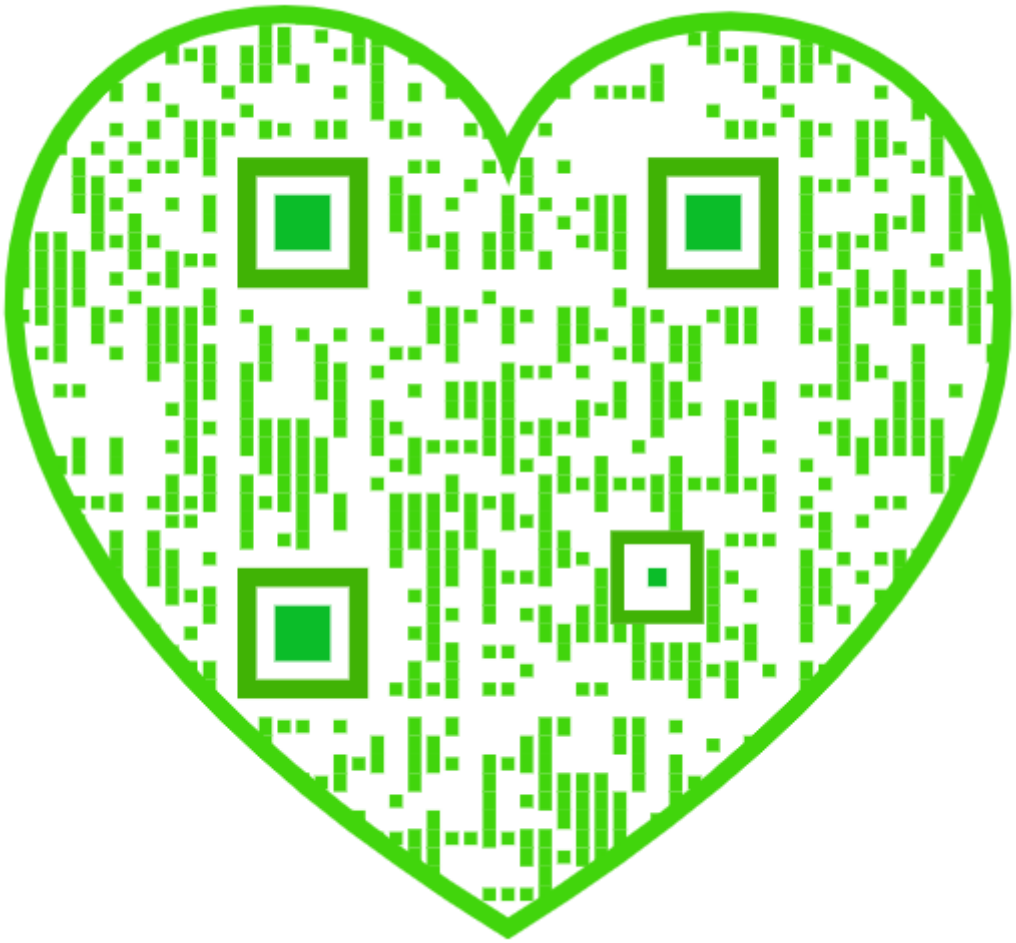
A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS CHEMISTRY AND MANUFACTURES.

Vol. LXXXII.—No. 15. ESTABLISHED 1845. | NEW YORK, APRIL 14, 1900. | $3.00 A YEAR. WEEKLY.



The "Kearsarge" on her Trial Trip. From a Photograph copyrighted 1899 by N. L. Stebbins.

TEST OF THE SUPERPOSED TURRETS OF THE UNITED STATES BATTLESHIP "KEARSARGE."—[See page 230.]



Scientific American.

ESTABLISHED 1845

MUNN & CO., - - - Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, - - NEW YORK.

TERMS TO SUBSCRIBERS

One copy, one year, for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845).....$3.00 a year.
Scientific American Supplement (Established 1876) ..... 5.00 "
Scientific American Building Edition (Established 1885). ..... 2.50 "
Scientific American Export Edition (Established 1878)..... 3.00 "

The combined subscription rates and rates to foreign countries will be furnished upon application.
Remit by postal or express money order, or by bank draft or check.
MUNN & CO., 361 Broadway, corner Franklin Street, New York.

NEW YORK, SATURDAY, APRIL 14, 1900.

NEW YORK'S WATER SUPPLY AND THE RAMAPO CONTRACT.

New York is in no danger of a water famine, alarmists' rumors to the contrary notwithstanding. In our recent discussion of this subject we showed that with an average total annual supply of 147,000,000,000 gallons, the consumption is only 92,000,000,000 gallons, and this with a daily per capita consumption probably larger than that of any other city in the world. It was also shown that the Boroughs of Brooklyn and Queens were amply supplied, the present daily consumption, though not as large as that in Manhattan and the Bronx, being, nevertheless, more than is necessary for the actual needs of householders; for, in the opinion of the Water Commissioners, the consumption, particularly in Manhattan and the Bronx, could be enormously reduced by the simple expedient of putting in self-closing faucets and the adoption of other means of reducing the present wilful and stupid waste of water. On the other hand it is a fact that the building of reservoirs and aqueducts is, in the nature of things, costly and tedious work, and, therefore, it is expedient that provision for increased water supply be made many years in adavnce of present necessities.

From our recent review of the subject, which will be found in our issue of March 24, it is seen that practically the entire supply of water is drawn from works belonging to the city itself. Taken as a whole the present system is an extraordinarily good one, and justifies the citizens in the determination that any further enlargement of the water supply shall be made at the public expense and owned and controlled by the city.

During the past few months New York City has been not a little agitated by the discovery that an organization known as the Ramapo Water Company which, for the past seventeen years, has been engaged buying up all the available sources of water supply throughout the State and in securing legislation designed to make it secure in the monopoly thus acquired, was about to obtain a contract from the Water Commissioners which would force the city to take its future supply of water from this company, paying therefor the enormous sum of $200,000.000. In contemplating this extraordinary proposition, one is impressed both with the audacity and magnitude of the scheme, and the silence and subtlety with which, through all these long years, it has been carried out.

The work of securing and making safe this monopoly had to be prosecuted in two different fields. On the one hand surveys had to be made of the various watersheds which might, in any way, be made contributory to the city, and also of the possible routes which might be followed by the aqueducts for conveying the water. The other field of operations lay within the halls of the Legislature, and in both fields the promoters of the Ramapo scheme appear to have been only too successful. They have secured options upon practically all the sources of water supply, and they have secured the right of way for pipe lines and aqueducts, paying therefor the nominal sum ordinarily required in such purchases. In the Legislature they have succeeded in taking away from the city the right of eminent domain, or, in other words, the city's right to condemn land for water supply purposes. Not only so, but the Ramapo Water Company has been granted special powers of condemnation not possessed by any other company eligible to contract with this city. The present situation resulting from these provisions as stated by the Merchants' Association of New York is as follows: First, an adequate water supply for the city of New York can be procured only by use of public powers to condemn water rights; second, the city is deprived of the power to condemn, or to buy indispensable water rights; third, no company eligible to contract with the city has been granted the power to condemn water rights, with one exception; fourth, the Ramapo Water Company alone has the public powers to condemn water rights; and only by contracting with the Ramapo Water Company to use those powers on its behalf can the city of New York obtain more water.

By the terms of the notorious Ramapo contract, the company has to deliver, by a gravity system of transmission, 200,000,000 gallons of water every day for a period of forty years from and after the first day of some specified month in the year 1902, the water to be paid for at the rate of $70 per million gallons. In view of the fact that the present supply of the greater part of this city is at last 100 per cent greater than the actual necessities of the city, it is seen how iniquitous would be the signing of a contract saddling the city with an additional and altogether superfluous supply, which is almost as large as the actual amount now required for the daily use of the city.

Some human rights there are, whether of a public or a private nature, which need no definition, and among these, surely we may place the right of a city to control its own supply of one of the primal necessities of life. That any private corporation should systematically set itself to buy up the water rights of the second greatest city of the world, just as the real estate speculator buys up the outlying farms of some booming Western city, is not to be tolerated.

Relief is being sought through the Legislature, and we are much pleased to see that in spite of the inevitable veto of the distinguished Mayor of this city, Governor Roosevelt has attached his signature to the Fallows Anti-Ramapo bill, which restricts the powers claimed by the Commissioner of Water Supply of the city of New York, forbidding him to enter into any water contract without the approval of the Board of Public Improvements and the Board of Estimate and Apportionment, and the separate written consents of the Mayor and Comptroller. Further legislation has been sought in the Morgan bill, which aimed at the restoration to the city of New York of its rightful powers of eminent domain, whereby it should once again be enabled to obtain any needed water supply by the exercise of the power of condemnation. Although the bill was defeated, it seems to us that the restoration of these rights would throw an additional and much-needed safeguard around the interests of the city.

THE PROPOSED DEPARTMENT OF COMMERCE AND INDUSTRY.

The wonderful progress which we have made in the last few years in the increase and extension of our export trade, has naturally resulted in the desire of our legislators to foster our commerce by all possible means. The proposal to establish a new executive department to be known as the "Department of Commerce and Industries," the head of which shall hold a seat in the President's cabinet, seems a wise one. In none of the departments of the government have we any bureau or division of the public service to which is committed the supervision of the manufacturing and mining interests of the country. In view of our great progress and our development in manufacturing industries, the products of which now far exceed our ability to consume at home; in view of the urgent necessity of securing more extensive markets abroad, it must be apparent to anyone who gives the subject the least thought that there is an urgent demand for an establishment of a department of the public service to have charge of, and aid in our industrial development, and to secure better and more extensive markets abroad. This fact has been recognized for many years by all the principal commercial bodies throughout the country, and there now seems to be an urgent demand in the industrial world for such a department. Most of the other governments have something of the kind. England has her Board of Trade; France, her Minister of Commerce, Industry and Telegraphs; The Netherlands, a Minister of Public Works and Commerce; Austria Hungary, a Minister of Commerce and National Industries; Italy, a Minister of Commerce, Industry and Agriculture; Spain, Portugal, and Russia also have similar officers. In all of these governments the fact is recognized that a department of this kind is essential and necessary for the care, promotion, and development of commerce and manufactures. The United States, in order to be on a footing of equality, and in order to be fully equipped to enter the competitive field with the strongest commercial nations ought to take a lesson from and be guided by these examples. In order to make such a department comprehensive and effective, and in order fully to equip it with the necessary appliances to execute its great task and purpose, all branches and departments of the public service relating and germane to the subject of commerce, manufactures and other industries ought to be vested in it.

Bills with this end in view have been introduced in both the house and the Senate, the latter being fuller and more elaborate, and it is the one likely to be considered in preference to the other. There is little prospect that the bill will be considered this session, but it is expected that it will be passed the next session of this Congress.

The Senate bill number 738 provides for a cabinet officer and an assistant secretary, and that the new department shall have general jurisdiction over the foreign and internal commerce of the United States, except in so far as regards the revenue and collection of customs. It shall also have general jurisdiction over all matters pertaining to transportation facilities by land or water, except in cases under the jurisdiction of the Interstate Commerce Commission. It shall have general jurisdiction over the Geological Survey, the mining industries, and the fish industries, as well as everything pertaining to the manufactures of the United States, including the securing of foreign markets. It is also intended that the new department shall have jurisdiction over Patents, Trade Marks and Copyrights.

Many bureaus and offices would be transferred from their old departments to the new one. Thus, the Treasury Department would have to give up the Life Saving Service, the Light House Service, Marine Hospital Service, the Steamboat Inspection Service, the Bureau of Navigation and the United States Shipping Commissioners, the Bureau of Immigration, the Bureau of Statistics, as well as the United States Coast and Geodetic Survey. From the Interior Department would be transferred the Commissioner of Railroads, the Patent Office, the Census Office, and the Geological Survey, and from the State Department, the Bureau of Foreign Commerce, which would be consolidated with the Bureau of Statistics transferred from the Treasury Department. The Director of the Geological Survey would be the Chief of a new Bureau of Geological Survey and Mining Industries. The bill also provides that the Department of Labor, and the office of the Commissioner of Fish and Fisheries be transferred to the new executive department. It will readily be perceived that the bureaus, departments, and branches of the public service that are transferred to the new department are all intimately connected with, and directly pertain to the subject of commerce, manufactures and the other industrial enterprises committed to the new department. It is estimated that the changes brought about by the transference of the various bureaus and the salaries of the new officers would not be greater than $50,000 per annum.

The secretary and the assistant secretary are to be appointed by the president and the salaries are to be respectively $8,000 and $4,000 per annum.

The transference of the Patent Office from the Department of the Interior to the Department of Commerce and Industries, would be a curious and interesting experiment. Provided that the internal affairs of the Patent Office are not interfered with, it seems as though it made little difference under which department it is classified, if it had proper representation in the Cabinet councils.

THE DOUBLE-TURRET SYSTEM ON TRIAL.

The favorable results of the recent trial of the double turrets of the "Kearsarge" can scarcely be overestimated in the far-reaching influence which they will exert upon the future designs of United States warships. Although the tests are not final, they were so far successful as to clear up many of the doubts which had existed as to the practicability of this novel and daring method of mounting the main battery of a warship.

The history of the double-turret controversy shows that the objections to the design may be summed up as of two kinds, structural and military. The structural objections which were raised chiefly, as they properly should be, by the Construction Department, have been met and successfully overcome by our naval constructors, who stated early in the history of the controversy that, if the turrets were finally approved on military grounds, they could and would overcome the mechanical difficulties involved in working out the installation. Briefly stated the structural objections are: The concentration of weight so near the ends of the vessel, tending to impair her seaworthiness; the risks in docking due to this concentration; the complication involved in concentrating at one point the large ammunition supply necessary for the four guns, and in the juxtaposition of the four ammunition hoists and the necessary power to work them; and last, and perhaps the chief of all, the abnormal stresses to which the substructure of the double turrets would be subjected from the simultaneous recoil of four heavy guns. These difficulties, however, have been cleverly met and removed.

The military objections might seem, strictly speaking, to be a matter for the exclusive consideration of the line officers who command and fight the ship. Indeed, the argument is advanced by them that as the structural side of the question has been completely solved, the problem has passed out of the hands of the Construction Department, and the determination of the value of the double-turret system and of its incorporation as a permanent feature in future battleships should be left to the officers of the line. We cannot say that we agree with this position, for it seems to us that a naval constructor has not only to devise proper means for disposing and protecting the guns, but he should be entitled to determine whether those dispositions are such as will secure the very best offensive and defensive results.

The military objections as expressed by Rear-Ad

miral Hichborn are: First, the danger of all four guns being disabled by one successful shot; second, the reduction in the number of the 8-inch gun positions, as compared with the "Oregon" type, and the attendant danger that in the last stages of a hard fought action no 8-inch fire would be available on account of disablement; and thirdly, the lack of mobility in the 8-inch guns, arising from the fact that they must be trained with the 13-inch guns beneath them, whereas it might be desirable to use the heavy guns on one portion of the ship and the lighter guns on some other.

All three of the above objections are of the "too-many-eggs-in-one-basket" kind, and it seems to us that while theoretically they are plausible, the teachings of our late naval war show that they may be pushed entirely too far. If the positive advantages of the system are evident—and they are admitted to be—these theoretical limitations may easily be exaggerated, as the following considerations will show. The argument against the concentration of four guns in one turret only possesses weight if the possibility of the turret's being hit is great. The engagements of the Spanish-American war prove that the risk is extremely, indeed ridiculously, small. In the naval battle off Santiago official statistics show that the total number of shots fired by the United States ships, exclusive of those from the "Gloucester," was 8,060. The Board of Naval Officers who examined the ships after the battle found that the total number of hits on the four Spanish vessels was 120, or about 1·5 per cent. Of these 120 hits, three only were recorded upon the turrets, which carried the main battery of 11-inch guns, so that our gunners, whom we consider to be the best in the world, while engaging the enemy at what may be considered a normal fighting range, had to fire 2,687 shells to score one hit upon the main turrets. We are considering, however, the question not merely of hitting but of disabling the turrets, and we find that of the three hits recorded, only one of them was made by an armor-piercing gun. Consequently we may assume that if a "Kearsarge" had been included among the ill-fated ships of the Spanish squadron at Santiago, she would have passed through that four hours' bombardment by the finest gunners in the world at the risk of receiving one vital blow out of 8,060 projectiles which fell upon the fleet.

Evidently we may put all of the eggs we may wish into the double-turret basket without much fear of their being broken.

Although theoretically it would be desirable to train the 13-inch guns on the barbettes, turrets and belt armor, and the 8-inch guns on the lighter casemate armor, the moral of the battle of Santiago is that such a nice selection will never be made by the gunner, who will be more concerned with hitting the target at all than with the determination of where he will hit it. At closer ranges, of course, more accurate marksmanship will be possible, but the present indications are that naval battles will be fought at long range, and that they will be decided more by the decimation of the crews than by the destruction of the ship itself. The trend of future construction will be in the direction of less armor, more guns, and an increased rapidity of fire. The double turret, by reducing the number of separate armored positions and permitting more weight to be put into guns, conduces very materially to this result.

FRENCH PRIZES FOR SCIENTISTS AND INVENTORS.

Scientific work is greatly encouraged in France by the prizes which have been established by the Académie des Sciences, most of these being founded by legacies which have been left for that purpose. The Montyon prize is an annual award of 700 francs, to be given to the person which the academy judges most worthy on account of an invention or improvements of instruments useful in agriculture, the sciences, or the mechanical arts. M. Louis La Caze has left to the academy a sum which yields 15,000 francs yearly, this being divided into three prizes, to be awarded every two years. One of these is given to the author of a work which has contributed the most to the progress of the science of physiology. The other two are for the best works on physics and chemistry. This prize is open to foreigners, and will be awarded at the public meeting of the academy in December, 1901. M. Henri W. Wilde has given the sum of 137,500 francs, which constitutes an annual prize of 4,000 francs to be awarded to the person who brings out a discovery or work in the branches of astronomy, physics, chemistry, geology, mechanics, etc., which is considered worthy of recompense by the academy. For this, the manuscripts or memoirs should be deposited with the secretary before the first of June, 1900. The Arago gold medal has been awarded yearly by the academy since 1887; it is given for a discovery or scientific work which is judged worthy of obtaining this honor. The Tremont prize is an annual sum of 1,100 francs, and is designed to aid a scientist or engineer, in the progress of whose work an assistance is necessary in order to obtain a useful result. At the annual meeting of the academy this prize will be awarded to the person who presents, in the course of the year, a discovery or improvement which best responds to the idea of the founder. The Gregnar annual prize of 4,000 francs is designed to aid a scientist who has already done important work, and whose researches could be better carried on by the help of this award. Madame Jean Reyraud has left an annual sum of 10,000 francs, to be awarded each year by one of the five sections of the academy. This is given for a work or series of researches of an original and useful character. The Jerome Ponti prize of 3,500 francs is awarded every two years for an important scientific work. The Leconti prize of 50,000 francs is awarded every three years for a new discovery in mathematics, physics, chemistry, etc., or a practical application in these branches which gives results superior to those already known. Electrical work has a special prize founded by Gaston Planté; 3,000 francs is awarded every two years for a discovery or important work in this branch. The two latter prizes will be given next year. Another prize relating especially to electricity is that founded by M. Kastner-Boursault; it is an annual sum of 2,000 francs, to the author of the best work upon the applications of electricity to the arts, industry or commerce.

These awards are made at the end of the year, at the public session of the academy, and in general, all communications should be made before the first of June of that year. A resumé of the work should be given, and it should also be indicated in what part the essential features of the discovery, etc., are to be found.

APPLIED SCIENCE IN MODERN WAR.

One of the notable circumstances connected with the present war in South Africa has been the wide and varied application of the results of modern science in regard to it. Setting aside altogether those of a purely military character such as firearms, quick-firing and machine guns, there are many other directions in which the influence of applied science may be recognized. We now perform a considerable portion of our scouting by balloons, and transmit the results of observations obtained from an altitude, supplemented by the aid of the field glass, to troops advancing or operating on the field. The best telescopes and an abundance of field glasses are always in requisition. By means of wireless telegraphy, and with the aid of kites communications has been successfully established between various stations occupied by the British troops in the theater of war in Africa. As regards the sanitary and medical service, says The London Lancet, stricter application of the rules of practical hygiene has obtained, resulting in a remarkably progressive improvement in the health of the soldiers in the field in the successive expeditions, which have taken place since the time of the Crimean war. Infective wound diseases, which in the past were a veritable scourge among the wounded in military hospitals, have been practically banished from them by universal and scrupulous attention to cleanliness and by the rigid use of antiseptic dressings in wounds and injuries, and by the performance of all operations while patients were under the influence of anæsthetics. The use of the Roentgen rays has enabled the surgeons to detect the presence and exact site of any missile or foreign body. These are some of the innovations for which applied science is responsible.

THE YOUNGEST SUBSCRIBER.

The SCIENTIFIC AMERICAN is the constant recipient of letters from the "oldest subscriber," and we are always pleased to hear from him. His age is variable but the term of his subscription invariably dates back to somewhere between the year 1845 and 1848. Some day we may seriously set out to determine just who is the most venerable of these correspondents; indeed, we would have done so long ago were it not that we feared to interrupt and discourage a type of correspondent that lies very near to the editorial heart.

The subject has received a novel variation in the shape of a letter from a Master William Arnold, who, while he may not be the oldest, is certainly the youngest subscriber. He writes, "I am only six years old, but I like to look at the pictures and hear the paper read to me. My brother Paul, who is eleven years old, reads to me, and sometimes papa."

DEATH OF ST. GEORGE MIVART.

Dr. St. George Mivart, who was formerly lecturer on zoology at St. Mary's school and professor of biology to the University of Louvain, died on April 1, at the age of seventy-two. The deceased was a scientist of a high order. He wrote a number of remarkable books, such as "Genesis of Species," "Nature and Thought," "Types of Animal Life," "The Cat," "An Introduction to the Elements of Science," "Man and Apes" and the "Origin of Human Reason." Dr. Mivart's name has recently been prominently before the public in a religio-scientific controversy.

THE Russian Agricultural Department has recently discovered in Kirghiz Steppe on the eastern shore of the Caspian Sea immense naphtha springs of a quality which is said to be equal to the best American naphtha.

PARIS EXPOSITION NOTES.

The New York Public Schools will be represented at the Paris Exposition by an interesting exhibit. A number of moving pictures will be taking showing the assembly and dismissal of pupils, the school workshop in operation, the cooking class at work, kindergarten games, gymnasium scenes and recess amusements. A hall has been set aside on the banks of the Seine to show the work.

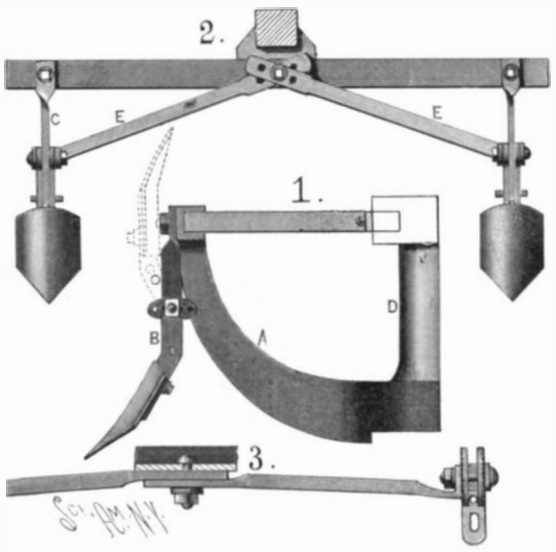
One of the attractions of the Paris Exposition is that known as the "Globe Céleste," consisting of an immense sphere of 46 meters in diameter, supported by four ornamental masonry pillars, the top of the foundation being surrounded by a terrace which has a height of about 40 meters from the ground. On the outside of the sphere are represented the constellations in their appropriate order, with the mythological figures proper to each, the whole being illuminated. The interior is reached by a stairway or electric elevators, and the spectator finds himself in the center of a second sphere 35 meters in diameter. In an artificial firmament are represented the sun, planets, nebulæ, etc., by means of electric bulbs of greater or less intensity and of various colors. In the center an earth of 8 meters in diameter turns on its axis and will accommodate one hundred spectators. By this rotation the sun and planets take the required movement; the moon revolves around the earth and changes its phases, and eclipses are also represented. Although these movements must be relatively rapid, they are proportionately exact. A great organ has been installed in the sphere, and space has been arranged for an audience of two thousand. In this will be given a series of organ recitals by celebrated composers. The exterior of the sphere is surrounded by an oblique circle representing the zodiac; this is arranged to form a staircase by which the visitors may circulate around the globe and obtain the view from the top.

Among the large dynamos which have been installed to furnish the lighting and power for the Paris Exposition, those of Germany are especially noteworthy. The German section takes up one end of the large dynamo building allotted to the foreign machines, and here are to be seen a number of alternating current dynamos connected to engines, most of which are of the upright type. Among the largest of the engines is that constructed by Borsig, of Berlin; it is of the upright compound type, and gives about 2,500 horse power. The dynamo is connected directly to the shaft of the engine, and has been furnished by Siemens and Halske, of Berlin. It is of the three-phase alternating current type, the field being mounted upon the interior flywheel, this consisting of a large ring carried upon spokes; upon the ring are mounted the field coils. The exterior armature consists of a large ring surrounding the field and is built up of laminated iron. The armature winding is made up of a series of copper bars placed in slots on the interior surface of the crown. Connected with a similar engine of 2,000 horse power is another large dynamo furnished by Schuckert and Company, of Nürnberg. Its construction is somewhat similar in appearance and electrical design to the former, the revolving field being mounted directly upon the shaft of the engine, and the exterior armature ring having its circuit made up of copper wire wound in slots. The Helios Company have a large alternator of similar design and capacity connected to a horizontal compound engine.

One of the remarkable features of the Foreign dynamo room is the great electric traveling crane of 25 tons, which has been installed by Carl Flohr, of Berlin, this being necessary in order to mount the large and heavy pieces of the machines of this section. It takes somewhat the form of the building, having two massive uprights of iron construction, about 28 meters apart, joined at a height of 12 meters by a horizontal beam which supports the traveling carriage. Above the beam the sides of the crane are joined by two parabolic segments forming an arch which takes the form of the roof of the building. The arch is braced at its apex by a trellis-work column descending to the horizontal beam. The uprights are spread out at the bottom, forming a wide base, and are supported upon rolling carriages, which run upon a double rail placed at either side of the building. The carriages are made as narrow as possible, to avoid taking up an unnecessary amount of space, and roll upon a series of small wheels placed one behind the other. The track is formed of two railroad rails placed side by side, having between the webs a rack in which engages the pinion of the crane. Half way up the side of the crane is a large platform which contains the necessary controlling apparatus for the motors. The carriage which travels upon the horizontal beam has a motor capable of lifting 25 tons to a height of 12 meters and a second smaller motor for the transverse movement of the carriage. A third motor is necessary to move the crane as a whole. The circuits of all these motors are brought to the switchboard upon the platform, and by a series of rheostat and controllers the attendant may regulate the movement of the heavy pieces of machines with great precision.

A LISTER ATTACHMENT FOR PLANTERS.

A patent has been issued to John L. Pate, Jr., Wauneta, Kas., for an invention which provides adjustable and folding lister-standards so proportioned relatively to the runners or shares that a deep furrow will be made for the seed. Fig. 1 is a side elevation of the runner of a planter with the attachment applied. Fig. 2 is a vertical section through the tongue of a planter. Fig. 3 is a horizontal section through the upper part of



A LISTER ATTACHMENT FOR PLANTERS.

a lister-standard and through a portion of the front beam of the planter-frame.

In the illustrations, *A* represents the runner of a corn-planter, and *D* the boot for conducting the seed to the bottom of the runner. The lister-standards are placed against the front upper portions of the runners and bolted near the ends of the front cross-bar of the planter-frame. Each standard comprises an upper section, *C*, received by a forked lower shovel section, *B*, adjustably connected by means of a segmental head formed with apertures through which pins are passed. Any desired inclination can be given to the shovels by passing the pins through any one of the apertures. When not needed, the shovels can be swung in the dotted position shown in Fig. 1. The lower section, *B*, of each lister-standard is composed of a straight upper portion to which an inclined shovel-carrying lower portion is secured by a pin which, when an impassable obstacle is encountered, breaks and allows the shovel to swing back under the planter. The lister-standards are braced by bars, *E*, which are secured to the standards by pins connecting the upper portions, *C*, with the lower portions, *B*. The braces cross below the tongue and are adjustably attached to the cross-beam. The attachment, it is therefore evident, can be applied to any planter whatever may be the distance between the runners, without interfering with any check-row appliance that may be used.

The length of the lister-standards is such that the points of the shovels extend below the level of the bottom of the runners, *A*, so that they open a deep furrow. When the earth falls upon the seed, a ridge is left at each side of the furrow, and the earth constituting these ridges at subsequent cultivation can be thrown upon the young plants to protect them at the roots and simultaneously to level the field.

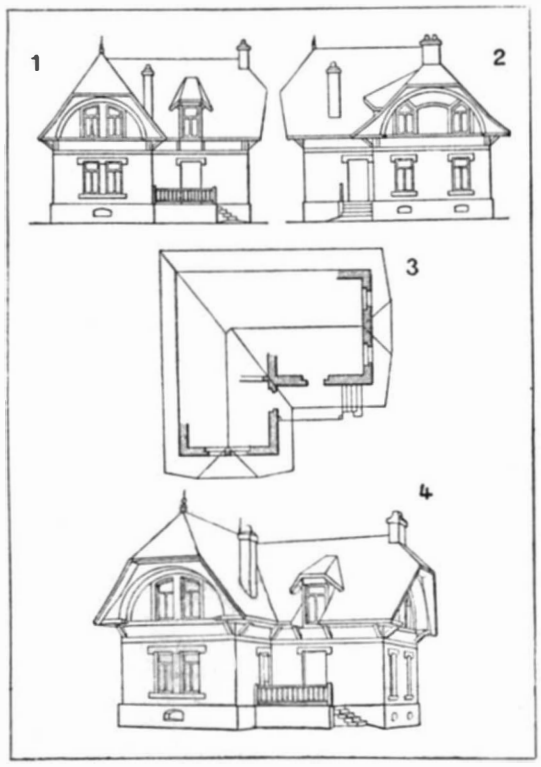


Fig. 3.—Nos. 1, 2, 3.—PLANS OF A VILLA USED FOR THE REPRODUCTION SHOWN IN No. 4.

Fig. 2.—PERSPECTIVE VIEW OF THE COURSE OF THE RHONE EXECUTED FROM A MAP.

APPARATUS FOR MAKING PERSPECTIVE DRAWINGS.

Every kind of structure, architectural, mechanical, etc., must, as is well known, be preceded by a detailed study, the result of which is expressed in the form of what is called a geometrical drawing, without which engineers, architects and machinery manufacturers could not get along. Now, such a drawing, which suffices to give specialists a clear idea of the structure projected, is not enough to satisfy those who have not pursued particular studies. What such persons require is a perspective view.

Unfortunately, the making of such a view, with the precision that is necessary, is not always easy, and requires in all cases a mathematical knowledge of operations that are quite lengthy and sometimes so arduous even that a number of skillful draughtsmen would be unable to perform them. This is why the invention of a relatively simple instrument, capable of automatically effecting such work with rapidity and perfect accuracy, would be of a nature to render important services to those who are called upon to perform it.

Such an apparatus, of wonderful simplicity, has been recently devised by Prof. Von Ziegler, an ingenious drawing master of Geneva. In closely studying the technique of perspective, this gentleman reached the conclusion that it would be possible to convert all the mathematical operations to which we have just alluded into a mechanical movement. Then, passing from theory to practice, he succeeded in constructing the apparatus represented in Fig. 1, which he styled the "Perspecteur."

We have seen it in operation, says La Nature, and have been astonished at the facility with which any inexperienced person can use it. It seems to us that this new invention is destined to become extremely popular, because of the manifold applications that may be made of it. Being given any geometrical drawing whatever, the latter serves as a basis for obtaining a perspective drawing in a few minutes, so that not only engineers and architects, but also geographers and painters will be able to derive genuine advantages from it, in applying it to the infinitely varied objects of their study.

It is a question, upon the whole, of a sort of pantagraph, which, instead of exactly reproducing drawings upon a larger or smaller scale, converts them from a geometrical into a perspective form.

Thus, to give two very striking examples, we present a view of a villa (Fig. 3, No. 4) obtained from the plans shown in Nos. 1, 2 and 3 of the same figure, and a panorama of the course of the Rhone, in the canton of Geneva (Fig. 2), made by the instrument from the map of the Swiss federal atlas of Siegfried.

Everyone may, from these examples, judge of the scope of the applications that may be made of the instrument, after a very little practice on the part of the user.

THE greatest precautions are being taken to protect visitors at the Paris Exposition. The prefect of the police has been at work for months in devising measures for the protection of life and property. He now has the most complete rogues' gallery in the world, and all classes of criminals will be looked after by specialists, who know them by sight or by reputation. Printed placards are to be placed in all public places warning visitors against confidence games, etc.

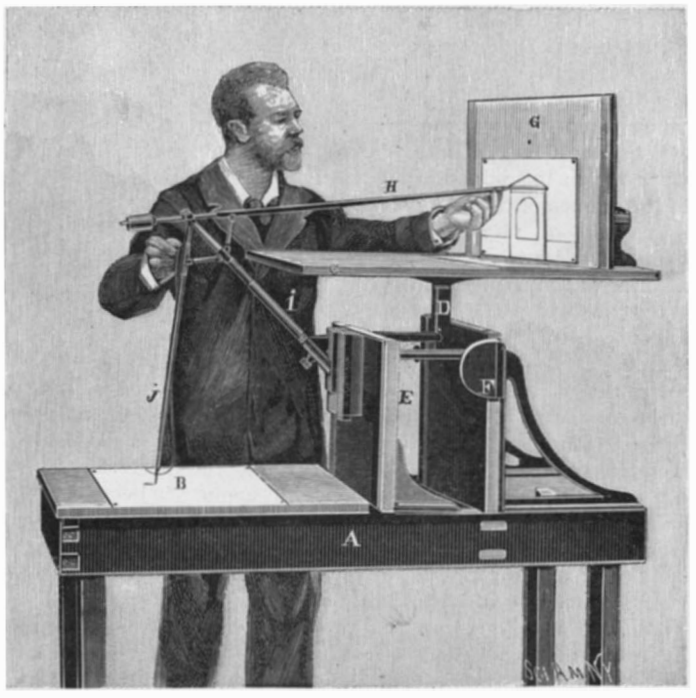


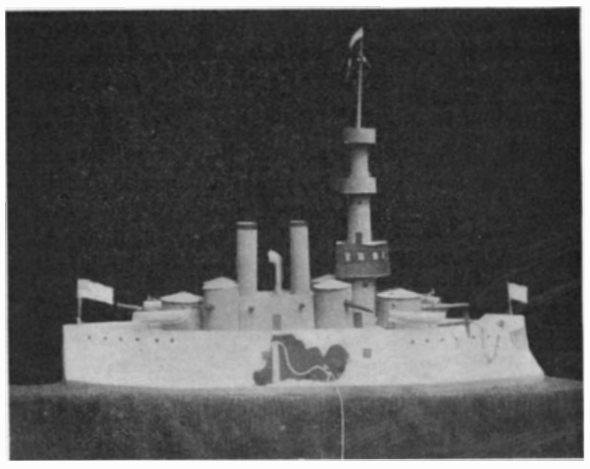
Fig. 1.—THE MECHANICAL PERSPECTIVE DRAUGHTSMAN.*

* The apparatus is fixed upon a table, *A*. At *B* is placed the paper upon which the perspective is to be drawn. *C* is a board on which is fixed the horizontal plan of the object to be represented. This board is mounted upon the frame, *E*, by means of the slide, *D*, and may be moved by the micrometric screw, *F*. *G* is the elevation board. *H*, *I* and *J* are compasses, of which the legs, *H* and *J*, are so jointed that the axis, *I*, is constantly the bisectrix of the angle that they form with each other. The two legs are telescopic. The directing leg, *H*, terminates in a point that is moved over all the parts of the geometrical drawing, while the leg, *J*, furnished with a pencil and an extension spring, traces the perspective of the same drawings upon the paper.

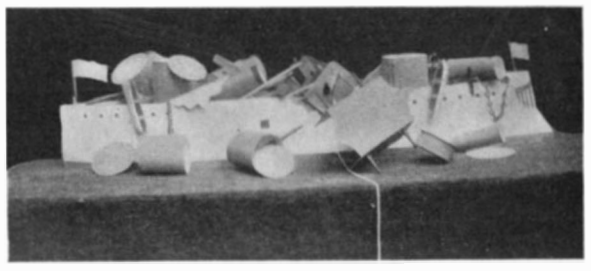
A SIMPLE INGENIOUS TOY.

The destruction of the battleship "Maine" has been cleverly reproduced in a simple toy invented by Mr. Charles M. A. Wichman, 130 W. Bay Street, Jacksonville, Fla.

The toy is made to represent a battleship which is provided with a central detachable deck-portion on which the turrets, separable masts, smoke-stacks, davits, and other deck-fixtures are loosely placed. Secured to



TOY WARSHIP ASSEMBLED.



TOY WARSHIP AFTER EXPLOSION.

the bottom of the deck, within the hull, is a small powder receptacle provided with a percussion-cap holder. A strong spring is secured to a support within the hull, its free end being held in a catch to which a cord is secured. Upon pulling the cord, the spring, released from its catch, flies up, strikes the percussion-cap, and produces an explosion which completely demolishes the vessel. Within a few minutes, however, the parts of the toy can be reassembled for another explosion.

The vessel is made chiefly of cardboard. Strips of wood are used for the deck and the bottom. The material used, although light, is durable enough to withstand many explosions.

Further Information Regarding the Prize for Aeronauts.

In addition to the information which we published on page 216 in our last issue, regarding the $20,000 prize offered for an airship test, we take pleasure in informing our readers that the prize must be won within five years, during which period 3,000 francs annually will be distributed to competitors toward defraying the expenses of their experiments.

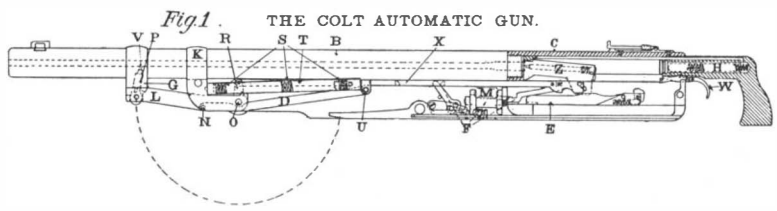
THE Ferris wheel, one of the great attractions of the World's Fair of 1893, is now located at Ferris Wheel Park, near the depot of the North Chicago division of the traction system. The view from the wheel in its present location is most beautiful.

THE COLT AUTOMATIC GUN.

Of all the death-dealing instruments being used in the South African war, it seems that a little rapid-firing automatic gun has dealt more terror to the hearts of brave men than all the other weapons put together. Time and again reports have come to show that the British soldiers who will face schrapnel and rifle-fire without a tremor, are apt to be "shaken," if they are exposed to the galling "pom-poms," as they have dubbed the Maxim automatics, used by the Boers.

Although the Maxim type is the most in the public eye just now, there are other forms of automatic gun which are scarcely less deadly. One of these, the Colt automatic gun, is shown in the two accompanying engravings, of which one a longitudinal section, and the other represents the gun as set up on its tripod, with the box of ammunition attached, ready for use. The Colt gun figured conspicuously in the operations of our troops during the Spanish war, and it is being used extensively by the British troops in South Africa. The Colt 30-caliber automatic gun has lately been tested for the army, and the 6-millimeter gun is used in the navy. The gun shown weighs forty pounds and is mounted on a tripod which weighs fifty-eight pounds. The maximum speed of fire is about 480 shots per minute.

Fig 1. THE COLT AUTOMATIC GUN.



SECTIONAL VIEW SHOWING DETAILS OF AUTOMATIC MECHANISM.

COLT AUTOMATIC GUN ON TRIPOD, WITH BOX OF BELT AMMUNITION ATTACHED.

The gun itself consists of a stout barrel, *B*, attached to a breech casing, *C*, which carries the mechanism for charging, firing and ejecting the shells. The cartridges are automatically fed to the gun by means of belts which are coiled in the box shown attached to the mount. The gun is operated by the pressure of the powder gases in the barrel, which act through a small radial vent, *V*, in the barrel, located somewhat to the rear of the muzzle. The instant the bullet passes this vent, the gases act upon a piston, *P*, which fits in a small gas cylinder, *G*, which surrounds the vent. The piston depresses the forward end of a gas lever, *L*, which is pivoted at the point *O*, and by means of a short lever, *R*, is held in the normally raised position by the action of the two parallel springs, *S*, which are partially indicated in the figure; the action of the springs upon the levers being to return the piston to the gas cylinder after it has been acted upon by the powder pressure. The piston serves also to operate through a rod, *D*, a sliding bar, *X*, which extends rearwardly along the casing and works the breech-bolt, *Z*, the feed mechanism, *F*, and the carrier, *E*. The breech-bolt is arranged so as to move backward and forward, closing the breech. When it is in the forward position the rear end of the breech-bolt swings downward, turning on its front end as a fulcrum, and in this position it is sustained by its abutment in the receiver.

In using the gun a feed belt is entered at the opening, *M*, in the casing, the position of which is shown more clearly in the illustration showing the gun set up, and the lever is pulled to the rear, preparing the piece for firing. On pulling the trigger, *W*, the hammer, *H*, which is caught by the rearward motion of the bolt, moves forward and fires the cartridge, whereupon the breech is opened, the empty shells ejected, and another cartridge is supplied by the feed, *F*, to the carrier, *E*, and placed in front of the breech-bolt, all of these motions being due to the rearward movement of the gas lever and connections actuated by the pressure of the powder gases as already explained. The cartridge is then forced home in the chamber of the barrel, and the breech-bolt is closed and locked by the forward movement gas lever and connections under the action of the springs. If the trigger is held back the same cycle of operations will be repeated as long as the cartridges are supplied.

One man can operate the gun, but two, one to fire and the other to enter the ammunition belts, are necessary to obtain the greatest rapidity of continuous fire with a number of belts. The gun and tripod are packed in cases and carried on a mule for the service of infantry and cavalry troops, and for use in rough countries. A light field-carriage and limber, a parapet mount for fortifications, and landing carriages for naval purposes, are also provided with this type of gun.

A Curious Geographical Blunder.

The Movement Geographique has recently published a long article about a curious geographical blunder relating to South America. The Tocantins River has been regarded as merely a tributary of the Amazon instead of being, as it is, an independent river basin. The writers on geography are only just beginning to treat the Tocantins as an independent hydrographic basin. It rises far to the south and has a great tributary, the Araguaya, which is even larger than the Tocantins. The joint streams form one of the great rivers of the continent with a width for a long distance of two or three miles, but the river is so impeded by rapids that it is not available for navigation until it widens into the great estuary on which Para stands. The Tocantins does not mingle in any degree with the Amazon and they reach the sea about 40 miles from each other. The chief reason why the erroneous identification of the Tocantins system with the Amazon basin has so long been perpetuated seems to be that the Tocantins basin is closely related with that of the Amazon tributary to the west, inasmuch as both flow from the same slope and in the same direction. A very small quantity of water from the Amazon does, however, enter the Tocantins through several narrow arms of the Amazon delta. This does not, however, make the two rivers belong to the same system.

THE GORDON BENNETT CUP RACE.

The conditions for the Gordon Bennett automobile cup race, offered by James Gordon Bennett, publisher of the New York, and Paris Herald, have now been formulated, and the race will take place on June 14, 1900. There is every indication that the event will be one of the most important which ever occurred in the automobile world. We take pleasure in presenting an engraving of the racing machine which Mr. Alexander Winton will use in the race. The motor contained in this carriage is about 10 horse power, and the complete machine weighs about 2,000 pounds. It is to be hoped that an American machine may win this important trophy, which is undoubtedly destined to occupy the same place among automobilists that the "America's" cup does among yachtsmen. Mr. Winton will find for competitors MM. Charron, René de Knyff and Girardot representing the Automobile Club of France. The Automobile Club of Belgium has also made entry and will select the three first Belgians in the Paris-Bordeaux race to represent them in the cup race, and Italian and German clubs will be represented.

The conditions regulating the competition for the cup are quite elaborate. All foreign automobile clubs that are recognized by the Automobile Club of France, are entitled to challenge and compete against the club which holds the cup. The sum of 3,000 francs must be deposited with the club holding the cup, this amount to be returned if one of the automobiles entered is present at the start and the qualified club wishing to challenge must give notice before the 1st of January, of each year, giving the number of automobiles which will compete for the cup. The cup can be competed for every year between May 15 and August 15, and if two or more clubs of the same country are included in the list of challenges, it is understood that this country could only be represented by three automobiles at the most. The exact date of the race is to be arranged for annually between the clubs interested.

The automobiles qualified for the races are those coming under the description given in the racing rules of the Automobile Club of France, which were published in 1899, and in brief, the automobiles must weigh more than 400 kilos, and carry at least two passengers of an average weight of 70 kilos. Four hundred kilos are counted for the weight of the automobile when empty, that is, without passengers or supplies, such as fuel, water, batteries, tools, luggage, clothing, etc. The automobiles must be constructed by members of the competing clubs in the respective countries of the competitors. The two seats must be occupied during the whole time of the race. Various provisions are made as to delegates. The race is a "go-as-you-please" one without any stipulated stoppage. The distance is to be from 550 to 650 kilometers. This distance is to be chosen between two towns or apportioned into several outward and homeward journeys, but in the latter case the minimum distance of each part is not to be less than 150 kilometers. The race is to take place in the country of the club holding the cup, with the option for this club to hold the race in France. Various arrangements are made as to starting the race. In the event of one of the clubs which had challenged being alone represented at the start, one of the automobiles of this club would have to cover the distance stipulated in the maximum time of twenty-four hours, failing which, the cup will be kept by the club challenged. It is understood that no club can ever become the owner of the cup, but they are to hold it only under the conditions fixed by the rules, and any club becoming the holder of the cup, or even challenging for it, must agree to abide by the rules on road racing which were published in 1899, and also by the rules of the Automobile Club of France.

THE WINTON MOTOR CARRIAGE WHICH WILL COMPETE FOR THE GORDON BENNETT CUP IN THE INTERNATIONAL RACE IN FRANCE IN JUNE.

Cost of the Chinese-Japanese War.

The Japanese Minister of Finances has recently published a report which gives an idea of the expense incurred by that nation in the war with China. This report covers a period of twenty-two months, from June 1, 1894, to March 21, 1896, although actual operations ceased about the end of April, 1895. The total expenses of military operations amount to $76,000,000, those for the marine being estimated at $18,000,000, making a total of $94,000,000. An itemized account is given, which shows that the transportation of troops and material reaches $19,000,000; provisions, $12,000,000; clothing, $10,000,000; pay roll, $8,000,000; arms and ammunition, $6,000,000: horses, $4,000,000; hospitals, etc., about $1,000,000. As to the marine, the expenses are divided as follows: Vessels, $6,000,000; arms and ammunition, $5,000,000; pay roll and provisions, each about $600,000; clothing, $200,000. In order to meet these expenses, the Japanese government has collected a revenue equal to $113,000,000. The difference between the expenses and the revenue, or $19,000,000, has been turned into the treasury to be used as a reserve. The report of the Minister of Finances ends by a reference to the indemnity paid by China. By the treaty of Simonosaki, this indemnity was fixed at $150,000,000; if from this sum is taken the $94,000,000 representing the expenses of the war, it will be seen that Japan has a balance in her favor of $56,000,000.

THE SUPERPOSED TURRETS OF THE "KEARSARGE."

It is safe to say that no recent design in warship construction has produced such a widely extended aud earnest discussion as that which forms the subject of the first page illustration of this issue. When it was first made public it was met with a storm of adverse criticism from the conservative element among naval officers, both of the line and staff; though it is only fair to say that the opponents of the double turret were to be found chiefly among the officers of the Construction Department, the obvious military advantages of the double turret commending it at once to the men who will carry our ships into action.

It is not our intention in the present article to enter into any extended statement or discussion of the advantages or disadvantages of the system, but rather to make clear to our readers the great ingenuity and skill with which the construction department has given practical expression to the daring suggestion of Lieut. Strauss, that four guns of the main battery should be installed in a two-storied turret, the 8-inch guns above and the 13 inch guns immediately beneath them.

The credit of the orginal design, undoubtedly, belongs to the gentleman named, whose idea received sanction and encouragement from Admiral Sampson, at the time chief of the Bureau of Ordnance, with which department Lieut. Strauss was connected.

When the matter came into the hands of the Bureau of Construction, several important recommendations were made and adopted, including the use of the oval balanced turret, which was coming into general use in European navies at that time, and the use of electricity for turning the turret, elevating the guns, and working the ammunition hoists. The many new features involved in these turrets, and the utter lack of precedent in the navy, rendered the details of the design a very complicated and difficult problem. That these were very aptly worked out by Naval Constructor Woodward, who, as superintending constructor, was in immediate charge of the work, is evident from a study of the drawings and proved by the success of the recent gunnery trials of the "Kearsarge."

The illustration on our front page is a vertical section through the "Kearsarge," taken on the center line of the vessel, and it affords a view of the complex structure of the vessel throughout its whole height from the keel to the roof of the upper gun emplacement. At the bottom of the section is seen the deep vertical keel plate which may be said to form the backbone of the vessel, whose height shows the depth between the outer and the inner bottom. The space between the inner bottom and the 3-inch protective deck is devoted to the magazines and handling rooms, the 8-inch ammunition being located above that of the 13-inch guns.

The handling room, so-called because it is the compartment into which the shells are brought and placed in the hoists to be carried up to the guns above, communicates through watertight doors with the magazines. The powder charges are contained in copper cylinders which are arranged neatly in racks in various compartments which lie immediately around the handling rooms, communication being had by way of watertight doors, while the other doors lead into similar compartments where the projectiles are stored. A system of overhead trolleys runs from the various magazines into the handling rooms, by means of which the powder and shells may be picked up from the racks and carried to the cages of the ammunition hoists. There are four of these hoists, two to each turret. Two of them start from the center of the 13-inch handling room, and slightly on either side of the vertical axis of the turret, and extend upwardly in an easy curve to the rear of the breech of the two 13-inch guns, there being, of course, one hoist to each gun. The hoisting is done by means of electrical motors, operating wire ropes, which lead through a system of pulleys up to the breech of the guns and thence down to the ammunition cage. The cage travels upon a curved plate-steel trackway, as shown. The arrangement of the ammunition rooms and handling rooms of the 8-inch ammunition is generally similar to that for the 13-inch guns, a plate steel trackway, smaller in size, but similar in general appearance and construction to the 13-inch hoists, running from the handling room up to the breech of the 8-inch guns, the cage being similarly raised by means of a wire rope operated by electrical motors. The 8-inch trackways pass between the hoists of the 13-inch guns, and the matter has been so carefully worked out, that in spite of predictions to the contrary, there is no interference between the two sets of hoists.

The protective deck, which in the "Kearsarge" is 3 inches thick, is indicated by the full black line above the 8-inch magazines. It slopes from the forward end of the amidship rapid-fire battery downward and forward to a junction with the massive structural work of the ram bow into which it is worked. Immediately upon it is built up the great circular wall of the barbette, which raises from this deck to project a few feet above the main deck of the vessel. The forward portion of it is 15 inches in thickness, but the sides and the rear, owing to the fact that they are flanked by a wall of 5½ inches of side armor on each side of the vessel, are only 12½ inches thick. Immediately behind this armor is a backing of oak timber, which in its turn is backed up by the heavy steel framing of the barbette. Within the barbette, and at a height of about 8 or 10 feet above the protective deck is a massive circular track upon which is carried, and upon which rotates, the massive double turret, the rollers upon which the turret turns being clearly shown in the engraving. Just inside of the circle of rollers and bolted to the circular table on which the track is placed, is a large circular rack which is engaged by the turning gear with which the turret is operated. The power for turning the turret is supplied by two 50-horse power electric motors which are located below the floor of the 13-inch turret. These motors revolve in the same direction, both driving through bevel gears a horizontal shaft which runs across the turret. The shaft carries at one end a right-hand and at the other end a left-hand worm, each of which engages with a worm wheel at the top end of a vertical shaft. At the lower end of the vertical shaft of each of the worm wheels is a pinion which meshes with the circular rack inside the barbette, thus driving the turret.

One 20-horse power motor is located under the central girder of the turret for the operation of each of the 13-inch ammunition hoists, the arrangement being shown in the illustration. Each 8-inch ammunition hoist is worked by a 6-horse power motor, and there are also special motors for elevating the 13-inch guns and for working the rammers which are located to the rear of the breech of these guns. There is also a system of electrically-driven ventilators, for blowing the gases out of the bores of the 8-inch and 13-inch guns after firing.

It will be noticed that whereas the front wall of the 13-inch turret lies within the circle of the barbette, the rear wall extends several feet beyond it. This is due to the fact that the section is taken on the longer axis of the turret, which is elliptical in shape, this form being better suited to the movements of the gun crews, reducing the unoccupied space at the sides and giving more space to the rear of the guns where it is needed. The elliptical turret is otherwise known as the balanced turret, the weights being so adjusted that there is practically no excess of load on any part of the turntable. The front walls of the turret are 17 inches in thickness, decreasing to 15 inches at the sides and rear.

The 8-inch turret is located somewhat to the rear of the center of the 13-inch turret, and is placed immediately upon the 3-inch steel roof of the latter; its front wall is 11 inches and its side and rear walls are 9 inches in thickness. The 13-inch turret is provided with three sighting hoods, one shown in section immediately in front of the 8-inch turret, and one being placed on either side of the 8-inch turret. It was feared that when the 8-inch guns were fired trouble would be experienced in these sighting hoods from the blast and the flame of the gases, but in the trials recently carried out off Old Point Comfort it was found that these hoods were tenable at all times.

The test of the "Kearsarge" above referred to was carried out for the purpose of determining whether the structure of the ship, and more particularly of the double turrets, could sustain the heavy strains which would be set up when the guns were fired, and especially by firing the four guns simultaneously. Both batteries of the double turrets and those of the rapid-fire guns amidships were tried under all possible conditions, and the results proved to be eminently satisfactory, both to Admiral Sampson and Captain William M. Folger, who is in command of the "Kearsarge." The results of the trial can best be given in Captain Folger's report to the Navy Department in which he says: "The double turret was was thoroughly tested and is an assured success both from military and structural standpoints. There was no interference between the planes of the guns, or inconvenience from blast or smoke. The structure, tested with the simultaneous discharge of three guns is amply strong to withstand the united shock of the four guns of either turret. Only the absence of a suitable device for the simultaneous discharge of all the guns prevented the final test. Both pairs of 8-inch guns were tested in simultaneous firing." In a subsequent test made a few days later, all four guns in both turrets were discharged simultaneously in broadside, without any harmful results to the structure of turrets or ship, or undesirable effects upon the stability.

A $20,000 Prize for a War Automobile.

The Emperor William, of Germany, who it is well known takes a keen interest in the latest inventions and improvements which are applicable to military operations, has been studying the question of applying the automobile in military service, and evidently considers that it will be of great value, as he has decided to award a prize of $20,000 for the vehicle best adapted to the purpose. A number of experiments have been recently made in this direction, and it is after considering the favorable results of the these tests that the decision to award the prize was taken.

Automobile News.

The Automobile Club, of America, will have a race on April 14, rain or shine, for a cup presented by M. Léonce Blanchet, of the Automobile Club of France. The race is to be of fifty miles over a course which has not been decided upon. There must be at least two people in each carriage, and the carriage itself must be driven by a member of the club; tricycles are barred. A diploma will be given to the first three drivers to finish.

It is said that an Alsatian company will purchase ground to the extent of $10,000 at Sablon, near Metz, for the purpose of establishing a bicycle and automobile factory. The company will besides furnish light and power to the communes of Montegny and Sablon. A large milling company of Metz have recently procured from Paris an automobile for heavy traction, known as the "train Scotte," operated by steam. It is similar in design to the type adopted by the French army far the artillery and engineering service, and has the boiler and engine mounted in front, with a space in the rear to carry merchandise. It is built to give 27 horse power and carries normally 10 to 12 tons of freight at a speed of 6 to 7 kilometers per hour. It appears that a new order for four of these automobiles is to be placed by the Metz company.

A new company has been formed at Bordeaux, called the Bordeaux Automobile Transportation Company, which will carry freight over a part of its route upon heavy automobiles of special construction. This company has been formed in connection with the Automobile Courier and Transportation Company. Its principal object is to transport, between Bordeaux and Mazamet, the sheep's hides brought to that port from America and Australia, and on the return trip to bring the wool and leather produced at the latter point to Bordeaux, from which it is shipped to Antwerp and Liverpool. To carry out the system proposed by the company, the hides will be unloaded from the transatlantic steamers into freight boats, which will pass up the Garonne to the lateral canal and the Canal du Midi to the Point Rogue. From there they will be transferred to the automobile wagons, which will travel over the national route to Mazamet, thus delivering the hides directly to the merchants of that district. The route passed over by the automobiles will be about 41 kilometers. The company estimate that four or five automobiles will be sufficient, on a basis of 12,000 tons annually.

The question of the use of automobiles in the French army is now occupying considerable attention. In connection with this subject, an interesting address was recently delivered at Lyons, by Lieut. Humbert, of the 121st Infantry, in which, after passing in review the different systems, electric, petroleum, etc., he showed the advantages and disadvantages of each type for military use and indicated what should be the qualities of a vehicle designed for this service. He shows, that the automobile will render a very important service in the colonies, in providing for the rapid supply of military posts and detachments, and describes the system of military automobiles which the government has recently put in action in Senegal. A similar system is now in consideration for Madagascar, which will cover the route between the port of Tamatave and Tananarive. On account of the difficulties of the route, the railroad which is to connect the coast with the interior has not yet been finished, and the automobile system will render great service in the construction of the road and besides will establish direct and rapid communication between Tananarive and the coast for the transportation of voyagers as well as for the postal service.

Mr. John Scott Montagu has recently given an interesting address before the Automobile Club, of Great Britain and Ireland, in which he brings out the condition of automobile affairs in England. He comes to the conclusion that although the automobile is greatly appreciated by the public, the slowness with which it is adopted is due in part to the flagrant violation of the rules by many of the owners, and besides, to the inferior quality of the machines now made in England. He considers that the constructors should study the question more carefully with regard to the needs of actual service, and should design motors which are more powerful and at the same time cheaper. In regard to the question of legislation, he thinks that the House of Commons regards the automobile with a more favorable eye than it did a year ago, and that if the persons interested do not press the matter with undue haste, there is no doubt that legislation will be secured which will be advantageous and will favor the development of the sport and the industry. In this connection it will be interesting to remark that the Prince of Wales has recently ordered a phaeton of the Daimler type, petroleum system, of about six horse power. This will no doubt start a favorable movement among the clubmen and amateurs of sport in London and other cities, similar to that which has made such rapid progress in similar circles in Paris and elsewhere on the Continent.

Science Notes.

The American water hyacinth which is not infrequently an obstruction to navigation, in southern rivers has been successfully killed on the Melpomene Canal, New Orleans, by a chemical spray.

There are now employed on the relief works of the famine districts of India 4,810,000 persons, and the distress caused by the famine is increasing in extent and severity and the prices of food are very high.

Some old quarries of Oriental alabaster have recently been discovered in the neighborhood of Monte Amiata, near Siena. It now seems very probable that the beautiful columns of that material in the interior of the Cathedral of Siena came from those quarries. The quarries are about to be worked.

The limiting percentages of acetylene and other gases in air which are explosible are as follows: Acetylene, 3 to 82; hydrogen 5 to 72; carbon monoxide 13 to 75; ethylene, 4 to 22; and methane, 5 to 13. This gives acetylene a wider range of explosive proportions than any of the other gases mentioned.

Prof. Henry S. Pritchett, superintendent of the Coast and Geodetic Survey, has resigned his place to accept the presidency of the Massachusetts Institute of Technology of Boston. He was the youngest superintendent that the Coast Survey has ever had, and he has been one of the most capable.

Several New South Wales lepers have been treated by a leprosy serum method devised by Dr. Juan de Dios Carrasquilla, of Bogota, and said by him to have been successful in a hundred cases. The Australian doctors, however, have been unable to detect any improvement, and the disease is still making progress.

Dr. William P. Wilson, Director of the Philadelphia Commercial Museum, and William Harper, Chief of the Bureau of Information of the same institution, have gone to San Francisco to assist the promoters of the Pacific Commercial Museum. A museum on the Pacific coast can do a great deal of good for the commerce of the country. It will, undoubtedly, divert much of the trade of Australia and the Orient on the Pacific coast.

Two French chemists have discovered a process by which rubber may be obtained from the Landolfia vine which grows wild, and luxuriantly in all parts of Africa. The process of tapping the Landolfia is impracticable, as the flow of rubber hardens too quickly. By the process of MM. Arnaud and Verneuil the vine is crushed in hot water, by which means all the rubber which it contains is extracted.

The Ways and Means Committee of the City of New York has recommended that $60,000 be appropriated to enable the State to acquire the James Hall scientific collection and library. It represents the accumulations made by the late Prof. James Hall during his entire active life in science and covers a period of seventy years. The palæontological collection is one of the most remarkable in the world.

George Peabody gave between the years 1862 and 1873 the sum of $2,500,000 for the building of model tenements for the London workmen. They have added to the fund since that time from rents and interest $3,956,000, making the total $6,456,000. The number of rooms provided for workmen is 11,367 which are divided into 5,121 dwellings, which are occupied by 19,157 persons. The average rent of each dwelling last year was $1.21 a week, and of each room 30 cents.

Secretary Gage has asked the House of Representatives to appropriate $200,000 additional to the fund to prevent the introduction and spread of epidemic diseases. The Surgeon-General of the Marine Hospital Service reports that on account of the continued and increasing danger from plague, medical officers have also been stationed at the fruit ports of Central and South America to guard against yellow fever. The Consulates at Yokohoma, Kobe and Hong Kong also have medical officers. Three hundred thousand dollars was previously appropriated and this sum is almost entirely exhausted.

Mr. W. Stratonoff, of the Observatory of Tachkent, has been engaged for some time in trying to determine the magnitude of the star which is to be found in the center of the annular nebula of the Lyre. In the period of four years, from September 5, 1895, to September 15, 1899, he has taken a number of photographs of this remarkable star, by using a good telescope having 0·83 meters opening of objective, with exposures varying from 30 to 90 minutes. By comparing its brilliancy with that of thirty of the neighboring stars whose magnitude is known, this astronomer has found several values which range from magnitude 9·5 to 13·1. The result obtained with a series of very long exposures was doubtful, but on the other hand, those obtained with exposures varying from 22 to 83 minutes have given a magnitude equal to 11·6. An exposure of ten hours gave 10·4, and one of twenty hours, 13·6. Mr. Stratonoff considers that this star is the result of a condensation of a part of the nebula; and finds that a long exposure diminishes the contrast which exists between the central condensed part and the exterior and less luminous matter.

Engineering Notes.

The railroads of East and West Java, says The Engineer, have recently been united, so that one can now travel from one end of the island to the other in two days.

A new invention provides for an arrangement by which turning on a faucet anywhere in the house starts the gas burning under a coil of pipe, thus providing hot water at any hour.

Dr. Michaelis, an Austrian authority on cements, considers that a mixture of Portland cement volcanic tufa and granulated blast furnace slag is better than Portland cement alone where structures are to be exposed to salt water.

A special mortar has been used in the German technical schools for powdering certain chemicals which must be handled with care. The mortar is provided with a flanged edge, and a skin of rubber is fitted over it. The rubber is not tightly drawn, and there is an opening in the center through which the pestle passes. The rubber skin keeps off poisonous vapors and injurious dust, and facilitates the pounding of hard brittle materials such as caustic alkalies.

In the Reichstag on March 20, in a debate on the management of State railroads, the Prussian government was taken severely to task on the subject of the antiquated system of couplings now in use in Prussia, a system which has occasioned many accidents. The Prussian Minister of Railways, replying to criticisms, stated that the government had heard of the satisfactory experiments on the Bavarian railroads with the American automatic coupler and would agree to undertake similar experiments during the coming summer.

The Swedish match industry has increased during the last year, in spite of European and Japanese competition. The original Swedish safety match is regarded as safer and cheaper than those manufactured elsewhere. The Swedish industry, however, will soon suffer from the want of wood. The injudicious cutting down of trees has produced the usual effect, and the destruction of slow-growing trees has not been accompanied by reafforesting, and has all but exhausted the stock of trees, so that the wood has now to be very largely imported from Russia and Finland. In 1898, 975,000 cubic feet of this wood came from St. Petersburg, Riga and Libau. Russia has now begun to manufacture safety matches herself, and export duties have been put on the timber.

The Cricket Ground at Sydney, Australia, has been lighted with acetylene gas and it has been very successful. Three thousand lights are in use. Suspended over the racing track are 163 shades, under which are a number of burners, the shade, of course, keeping off the wind and rain. Shades are attached to light angle iron supports 15 feet from the track and 16 feet apart. The pipes are 8 miles in length, and run from the outside right over the track to the inside and have to be suspended by very thin supports in order that the public's view will not be interfered with. The lights are practically steady, and gas is furnished by three batteries of generators. It is found that the light has no straining effect upon the eyes of the spectators, and in addition the colors sported by the contestants present their natural hue.

The effects of the great dynamite explosions at Avigliana, near Turin, on January 16, have recently been described by Dr. M. Baratta, says The Engineer. About 400 kilos of nitro-glycerine and 12,000 kilos of dynamite and gun-cotton were blown up. The first and stronger explosion, though it lasted little more than a second, presented three maxima of intensity, due probably to the successive explosions of magazines a hundred meters from that in which the nitro-glycerine was stored. Owing to the situation of the manufactory, the zone of greatest damage was very small; that in which windows were almost totally destroyed extended to a distance of 5½ kiloms.; doors and windows were made to rattle as far as Crescentino, 60 kiloms. distant; and the sound of the explosion was heard at Pavia, 140 kiloms.; Varzi, 145 kiloms.; and Lugano, 160 kilometers.

A Cleveland engineer has invented a machine for the automatic manufacture of steel balls. The machine automatically forms and polishes steel balls, which are entirely spherical, at the rate of 65,000 a day. Cubical pieces of hot steel, each of which is to be made into a ball, are fed into the top of the machine, one at a time. The principal parts of the machine are a cone of steel 2 or 3 feet high, and a cover of steel which fits over it. In the face of the cone is a groove that winds around it from the top to the bottom, growing smaller as it nears the bottom. There is another groove on the inner surface of the cover that matches that in the cone. The cone is kept whirling all the time, and when a piece of steel is put in at the top, it is worked downward through the spiral groove, which rolls it on all sides and in all directions, and drops it out of the bottom of the machine, a perfect sphere of steel. The fibers of the steel are not cut, but instead, are packed together even more tightly than when cut from the rod.

Electrical Notes.

The new motor fire engine of the Paris Municipality is doing excellent work. It rendered valuable assistance at the Trianon theater fire, and at the St. Ouen spirit warehouse fire. The engine carries six men, and travels at the rate of thirteen miles an hour.

Viennese telephone girls are required to change their clothing and wear a uniform when on duty in order that the dust which they bring in with them will not interfere with the instruments. The costume is a dark skirt and waist with sleeves, striped black and yellow, the national colors.

The hardened end of a steel bit or chisel broke off in a bore hole at a depth of 990 feet in a place in Germany, and this obstruction prevented further boring of the hole because all the diamonds wore away. The following plan was hit upon to remove it. A soft steel bar, 5 feet in length and 2·7 inches in diameter, was covered by a single winding of India rubber tape, and magnetized by the current of a small dynamo driven by a portable engine employed for the work of boring. The steel bar was let down magnetized into the hole and when it reached the bottom the current was switched through the conductor enclosed in the rope for letting down and drawing up. On the first day that this method was employed the piece of steel was drawn up to the surface, so that the boring could be resumed.

The committee in charge of that section of the Paris Exposition relating to sports and physical exercises has under its jurisdiction the boat races which will take place on the Seine. These include a number of interesting events, one of which is a series of races between mechanically propelled boats of all kinds, such as steam, electricity, compressed air, petroleum, etc. Two races have been set apart for this class; these will take place near Paris on June 23 and 24. The boats are divided into four sections according to their length, this ranging from 6½ to 15 meters or over. In each section, the boats, even though possessing different types of motors, will run together, but a prize will be awarded to the winning boat of each class, steam, electricity, etc. On the first day a distance of 50 kilometers will be covered, and the prizes will range from 1,000 to 2,500 francs. The distance for the second day has been fixed at 15 kilometers, with prizes from 300 to 600 francs; the prizes will take the form of objects of art, medals, etc. The rules to be observed as those of the Helice Club of France, and engagements should be sent before June 15, to the president of the club, the Count de Faramond, 14 Rue Vaneau, Paris.

In some fluorescent screens used for Roentgen ray work, notably those made of Sidot's zinc sulphide, a certain time effect is observed at each operation. The bones of the hand are not visible at once on the screen. They gradually separate out from the flesh. This effect is only partially due to a change in the radiation impinging upon the screen. We know that a "hard" tube gives more decided radiographs, and the effect might be attributed to the hardening of the tubes while in action. But, on the other hand, a gradual and distinct brightening of the screen is observed, which is quite independent of any change in the radiation and is unaccompanied by any change of color or of chemical constitution that could be discovered by any means at present available. J. Precht has studied the time effect both in sulphide and in platino-cyanide screens. He finds that the time required for a good development of the radioscopic picture is on the whole shortest at the highest discharge potentials. It varies from a few seconds to a minute. The most obvious explanation lies in an allotropic modification of the substance of the screen, as postulated by Becquerel for radium rays. But the author puts forward an emission hypothesis of Roentgen rays.—J. Precht, Ann der Physik, No. 2, 1000.

The London Electrician says that one of the most extraordinary magnetic anomalies is presented by the province of Kursk, in Russia. At the invitation of the Imperial Russian Geographical Society, the French Minister of Public Instruction sent Prof. Moureaux to make a magnetic survey of that region. Taking the town of Kursk as a base, Prof. Moureaux made excursions to 109 different stations in the province. The plateau between the Plota and Solotinka Rivers extends over an area of about 2 square miles. In this restricted area the declination was found to vary from 34° E. to 96° W., and the inclination from 48° to 79° values which correspond respectively to the normal inclinations in Morocco and Spitzbergen. But the most remarkable abnormality is to be found in the intensity, which yielded horizontal components varying from 0·50 to 0·59, and vertical components exceeding 0·97. The observations have since been continued by Prof. Leyst, of Moscow, who found a point near Kotchetowka where the dipping needle points vertically. There is nothing observable in the surface conditions of this region to explain its magnetic characteristics. It is a rolling country, covered with a very fertile black soil reposing upon cretaceous rock. No iron has been found down to depths of 600 feet below the surface.

THE WATER TRANSPORTATION OF GRAIN.

BY WALDON FAWCETT.

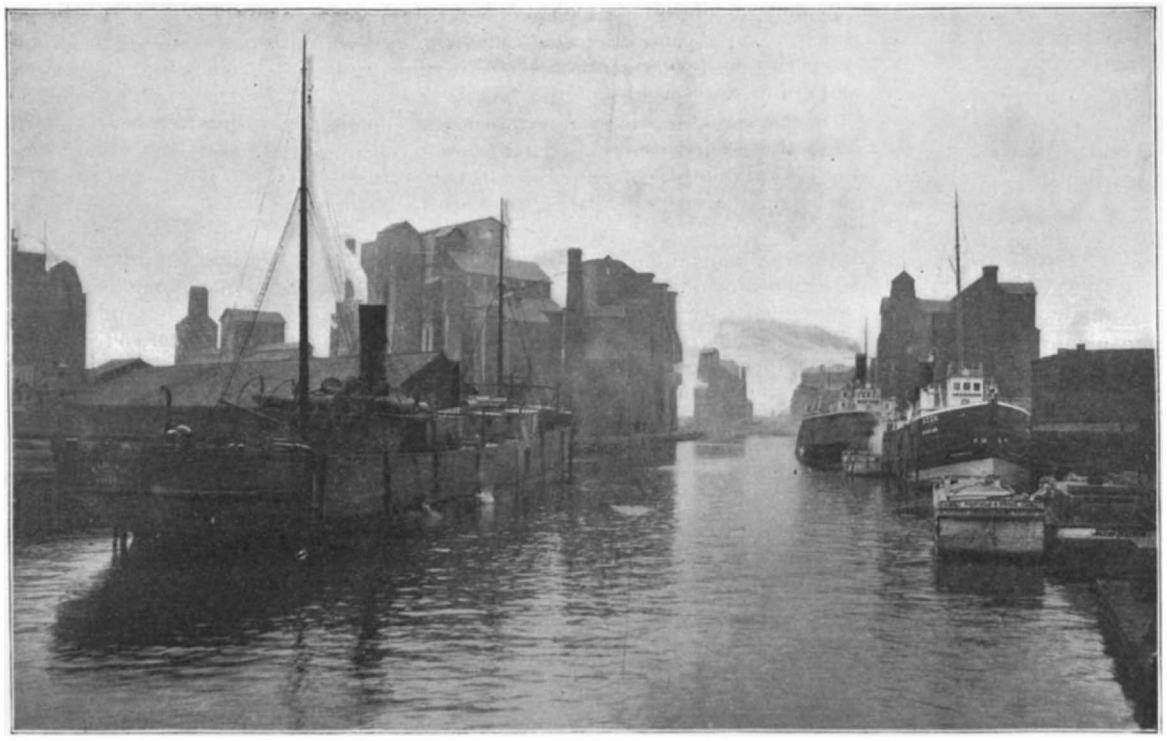
The grain trade of the United States, or rather that phase of it which is embraced in the transportation of the grain from the harvest fields of the Northwest to the seaboard, is in what might be termed a transitory stage. Some radical new methods, designed to effect a saving in cost as well as economy of time, are just being introduced, and affairs have not as yet wholly adjusted themselves to the new influences.

In the first place, there has been a sudden development within the past year or two of new ports of export. Formerly New York had the lion's share of the business connected with the reshipment of grain designed for European consumption, but of late other ports, notably Newport News, Va., and Galveston, Tex., have entered the field as most aggressive competitors, and the opening of the Chicago drainage canal and the advocacy of a system of waterways to connect the Great Lakes with the Gulf of Mexico has served to revive the old project for a line of steel barges for the transportation of grain on a large scale via the Mississippi to the seaboard. Second in importance comes the project of an American and Canadian syndicate headed by W. J. Conners, of Buffalo, for the construction of great elevators at Montreal and the provision of an outlet for the export grain via the St. Lawrence route. This plan has the advantage that will accrue from the fact that the grain will have to be rehandled but once, for, by using the enlarged Canadian canals just completed, grain-carrying vessels may be operated from the elevators at ports on Lake Superior clear through to Montreal.

Finally we have the appearance of the railroads as more active competitors than ever before of the grain-carrying vessels of the Great Lakes. Partially from the fact that Duluth, Chicago, and Buffalo, three of the greatest elevator centers in the country, are situated on the Great Lakes, and partially from the low carrying charges secured, from two-thirds to three-fourths of all the grain shipped to the Atlantic seaboard from the Northwest was transported, previous to last year, by the water route. It became apparent from the outset of the season of 1899, however, that the railroads intended to make a fight for this business, impelled in part, possibly, by the fact that there was a prospect of the adoption of higher freight tariffs on the lakes. How well they succeeded may be imagined when it is stated that in the case of Chicago there was an absolute reversal of the conditions whereby the lake boats handled 65 per cent of the grain trade.

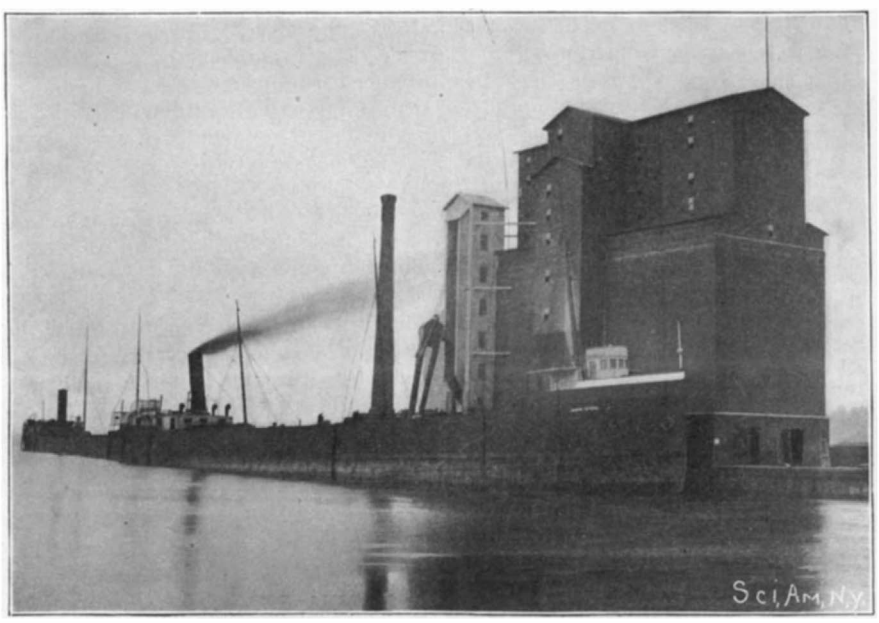
From estimates based on the latest statistics it is figured that the movement of grain on the Great Lakes each year amounts, if flour be included as wheat, to fully 350,000,000 bushels. To convey an idea of the magnitude of this aggregate is rather difficult, but it may be stated that fully 50,000 cars or 1,250 ordinary sized trains would be required to transport such a bulk of freight. Of the total given, about 125,000,000 bushels comes from the American and Canadian ports on Lake Superior and fully 160,000,000 bushels may be apportioned as Chicago's share. Milwaukee ships annually by water some 30,000,000 bushels of grain, and the other ports handle smaller fractions of the whole. The grain in its journey eastward follows, for the main part, the principal arteries of traffic. More than three-fourths of all the flour and grain which comes down the lakes by boat each year is consigned to Buffalo, where there are elevators with an aggregate storage capacity of 20.000,000 bushels and where the daily receipts of grain will amount at times to fully 2,000,000 bushels. At Buffalo the grain is transferred to Erie canal boats or to the railroad trains which carry it to the ports on the Atlantic seaboard. Much of the grain which does not come to Buffalo takes the Canadian route by way of the Welland Canal and St. Lawrence River. It is this traffic which the new American syndicate, above mentioned, seeks to develop and enlarge. Finally, a very small proportion of the business goes through ports on Lake Erie, which have elevator and warehouse facilities for transferring the grain to railways. The charge for carrying the grain has differed considerably at different times. The year following the Civil War the average rate paid for all the wheat which was moved by boat from Chicago to Buffalo was over 12 cents per bushel. Then it dropped, until, during the six years ending with 1898, the average never once reached 2 cents per bushel. In addition to this there are charges in connection with the "trimming" of the vessel, the tallying of weights, and the shoveling of the grain in the hold of the vessel to bring it to the elevator spouts when unloading, which amount, under present conditions, to about $4 per one thousand bushels. The proportions of the different kinds of grain may, perhaps, be best indicated by the receipts at Buffalo. In years when the total amount of grain brought to Buffalo reaches 275,000,000 bushels, the apportionment will be approximately as follows: 83,000,000 bushels of wheat; 67,000,000 bushels of corn; 45,000,000 bushels of oats; 11,000,000 bushels of barley; with the remainder distributed almost equally between rye and flaxseed.

Perhaps the best idea of the important place which the grain trade holds in the commerce of the great inland seas may be obtained from the reports of the Sault Ste. Marie Canal, through which there passes in the eight months of navigation each year two or three times as much freight as passes through the Suez Canal in the full year. As the Sault Canal is in the river connecting Lakes Superior and Huron, only a portion of the grain, that from Lake Superior ports, passes through it, and the shipments of the commodity from Chicago are not represented. During the year 1899 there passed through the canal upward of 90,000,000 bushels of grain. This was valued at $61,000,000, or more than any other commodity. The shipments of iron ore and general merchandise were the



Photograph copyrighted 1900 by the Detroit Photographic Co.

THE GRAIN ELEVATORS AT BUFFALO.



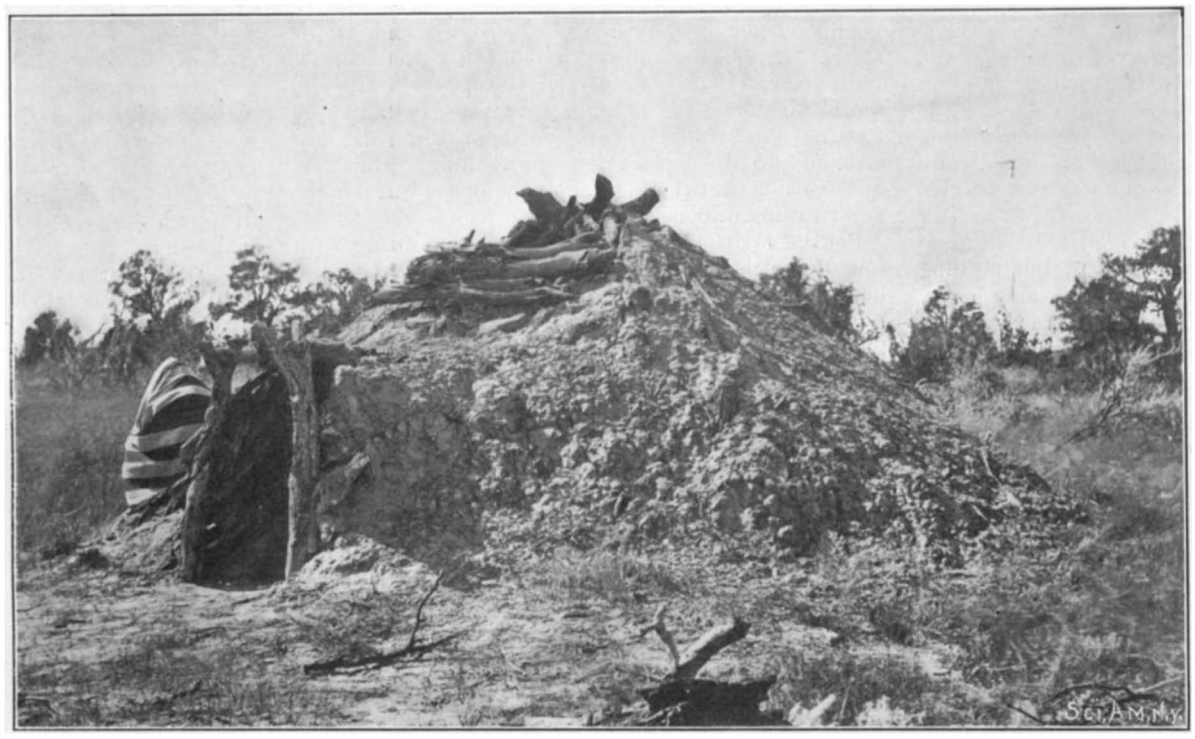
LOADING GRAIN VESSELS AT OWEN SOUND, CANADA.

Photograph copyrighted 1900 by Detroit Photographic Co.

TRANSFERRING WHEAT FROM A BARGE INTO ELEVATORS, BUFFALO.

closest competitors, each being valued in the aggregate at $52,000,000. If flour be included with the grain, the total valuation would be brought up to $85,000,000. For purposes of comparison it may be noted that the total value of all freight passing through the canal during the year was $281,000,000. Some of the steel steamers engaged in carrying grain on the Great Lakes have made remarkable records. They are, many of them, vessels of 400 or 500 feet in length, in some instances towing another vessel almost as large behind them, and it is not an infrequent occurrence for one of these huge freighters to travel more than 40,000 miles during a season of ordinary length. The steamer "Malietoa," which is owned by the Minnesota Steamship Company, of Cleveland, enjoys the distinction of having carried the largest cargo of grain in the history of lake commerce. Some months ago she moved from Duluth to Buffalo 195,000 bushels of flaxseed and 70,000 bushels of wheat, the whole being equal to 7,500 net tons. The steamer "Superior City" carried 266,000 bushels of corn, equivalent to 7,460 tons, and third place must be accorded to the steamer "Andrew Carnegie," the 5,300-ton cargo of which consisted of 332,000 bushels of oats. If any evidence were lacking of the confidence of the men in the grain trade that its development has only just commenced, it might be found in the immense sums of money being invested in the construction of new elevators, particularly at Chicago and upper lake ports. Really magnificent structures many of them will be, constructed of steel throughout, with a capacity of from one to two and a half million bushels, operated by electricity, fitted with new, improved machinery for scouring, cleaning, and drying the grain, and fully protected against fire by most elaborate systems. The largest elevators now under construction are building at the head of Lake Superior and at Chicago. The present elevator capacity at the latter city amounts to about 65,000,000 bushels, and this will be somewhat increased by the new elevators, one of which will have facilities for unloading four hundred cars of grain every twenty-four hours. Undoubtedly the most interesting elevator yet constructed will be the initial plant now under construction for the new American and Canadian syndicate at Montreal. The main structure will have a capacity of 1,000,000 bushels, and the annexes will provide storage for at least 2,000,000 bushels additional. Steel, concrete, and wood will be the materials used in the construction of the buildings, which will be as near fireproof as possible. The entire plant when completed will have cost fully $700,000. The Canadian ports, such as Owen Sound and Fort William, which constitute the gateway for the immense grain fields of the Canadian northwest, which hold such unlimited possibilities for the future, have also shown a marvelous development during the past few years. At Owen Sound there have been erected elevators capable of holding between one and two million bushels of grain. At Fort William the Canadian Pacific Railroad Company has expended $2,000,000 in providing four large elevators which have an aggregate storage capacity of considerably more than 5,000,000 bushels and the largest of which is capable of shipping 40,000 bushels per hour. This elevator is unique. It is constructed with two dozen cylindrical steel storage tanks, each 60 feet high and almost as broad, and which are not only absolutely fire and damp-proof, but are rendered impervious against rats, insects, etc. A distinctive feature of the structure is found in the fact that the machinery for cleaning, separating, and weighing the grain is in an entirely separate building.

Possibly the most dramatic phase of the water transportation of grain is found in the unloading of the grain at the elevators. The grain is conveyed from the hold of the lake steamer by means of an endless chain of buckets working in a spout or "leg," which is lowered through a hatch. Inasmuch as the lake vessels have anywhere from twelve to fifteen hatches, several of these legs may, of course, be operated simultaneously. Large gangs of men, assisted by steam shovels, must be employed to draw the grain to the mouths of the spouts, and it is the grievances of these men, who have objected to the plan of awarding the contract for unloading all the grain boats to one man, who retains several cents per thousand bushels as his net profit, that have caused the serious labor disturbances at Buffalo within the past year or two. When it is remembered that the largest grain-carrying vessels on the lakes are loaded or unloaded in the interval of a few hours, and that the cost of moving freight on the Great Lakes is only a fraction above a mill per ton per mile, whereas a cost of four mills per ton per mile is about the lowest reached on the railways, it will be appreciated that the water transportation of grain as conducted in the United States indeed constitutes one of the marvels of the commercial world. Moreover, improved unloading machinery and larger ships and elevators are coming, so that it is hard to predict the ultimate outcome.



A TYPICAL NAVAHO HOGAN.

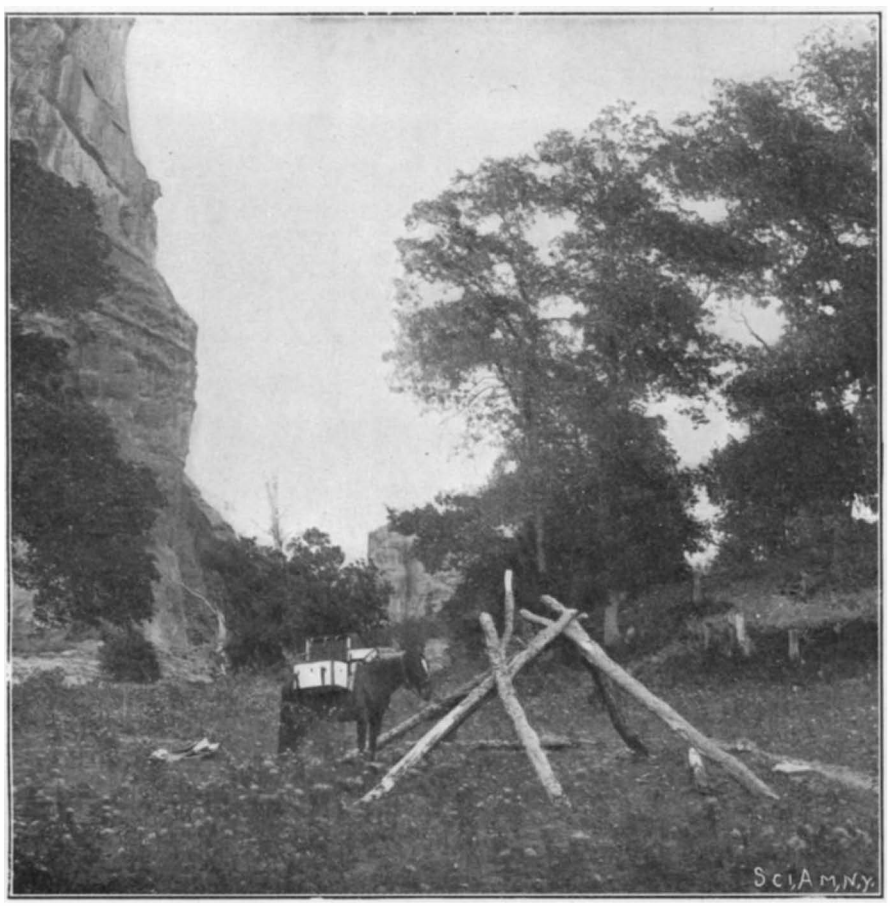
HOUSES AND HOUSE DEDICATION OF THE NAVAHOS.

BY COSMOS MINDELEFF.

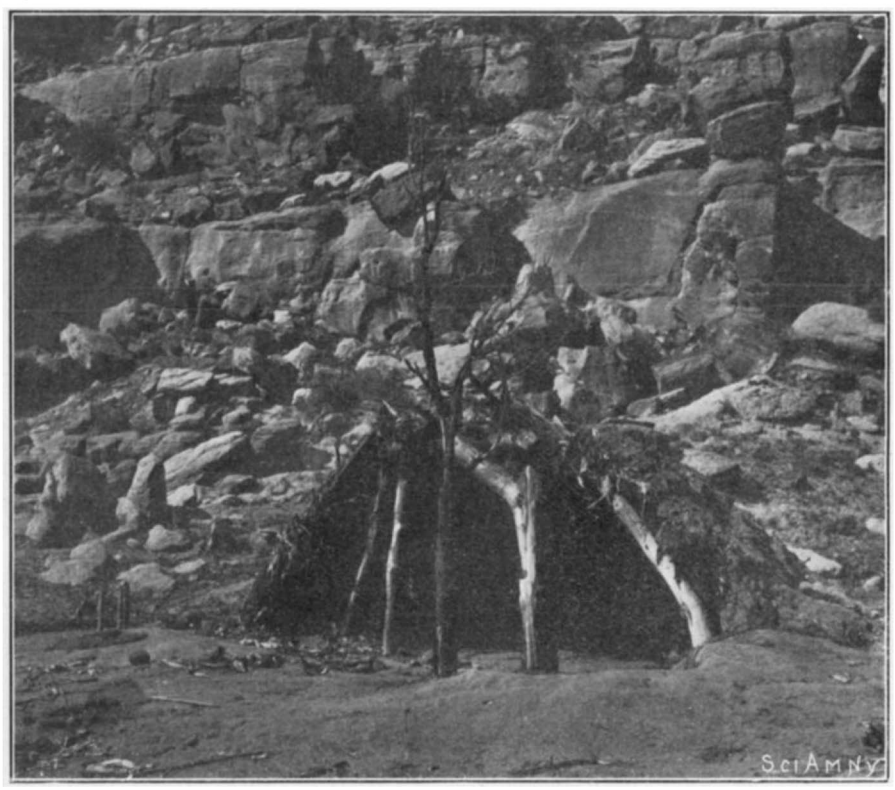
The study of the houses and house-life of the American aborigines, inaugurated by Lewis H. Morgan more than a quarter of a century ago, has progressed to that point that America is no longer open to the reproach made by Ferguson in his "History of Architecture," that the only chapter in the great work which could not be written was that pertaining to the Western Hemisphere. Since that day a large amount of work in the way of investigation has been done and much has been written, but singularly enough attention has been largely confined to the Pueblo and Aztec architecture, while the more primitive, although not less interesting forms have been practically ignored, except by Morgan himself. No tribe of Indians offers a better opportunity to supply this deficiency than the Navahos of New Mexico and Arizona, who, until quite recently, were but little affected by the march of civilization, and in their houses retained almost unchanged the ideas and the customs of centuries ago. An exhaustive article on the subject by the writer is now in press and will soon be issued by the Smithsonian Institution.

Rude and primitive as the houses of the Navahos appear, or the hogans, as they themselves term them, every detail is dictated by rules rigidly adhered to, and the erection of one of them is a real ceremonial, almost always followed by an elaborate ritual of dedication. The omission of any part of the ceremony or of the ritual, or its performance out of its regular order, would be followed, it is believed, by the most disastrous consequences. It is only with the passing of this belief in the last decade or so that variations from the fixed type have crept in, but thousands of examples of the old form are still to be found on the Navaho Reservation, and hundreds are built every year.

The hogans are usually hidden away so effectually that the traveler who is not familiar with the customs of the people might travel for days and not see more



FRAMEWORK OF A HOGAN.



A HALF-HUT OR SUMMER SHELTER.

than a dozen of them, and he might even get the impression that the country is practically uninhabited, yet the tribe numbers over 12,000 souls, and probably there was no time during the day when he was not under observation by several pairs of eyes. The site the Navaho prefers for his home is either some sheltered nook in a mesa or a southern slope on the edge of a grove of piñon or cedar. Very seldom is a house built close to a spring or other water. It is probable that this custom of half-concealed habitations is a survival from the time when the Navahos lived by plunder and momentarily expected reprisals from their victims.

When the site is selected the family moves to the place, taking all their possessions with them, including flocks of sheep, and goats and herds of horses and cattle. The hosteen, as the head of the family is called, drives the ponies and cattle; he carries his arms, for the coyotes may be troublesome at night, two or three blankets, and a buckskin on his saddle, but nothing more. After him comes a flock of sheep and goats, bleating and nibbling at the bushes and grass as they slowly trot along, urged by the dust-begrimed squaw and her children.

The selection of a site is by no means a simple matter, for, aside from convenience, a number of mythologic considerations enter into the problem.

A site having been found, search is made for suitable trees. Three of them must terminate in spreading forks, but the other two, which are intended for the door frame, are chosen for their straightness. The timbers are laid on the ground with their forked ends together, somewhat in the form of the letter T, extreme care being taken to have the butt of one log point exactly to the north, another to the south, and the third to the west. The straight timbers are then laid down with the small ends close to the forks of the north and south timbers, and their butt ends pointing due east.

A house building is a semi-social ceremony, something on the order of the "log-raising" in the early days in the West, and there is always an abundance of help for all the operations necessary.

When the tsadi, or frame of five timbers, is completed the sides of the structure are filled in with smaller poles and branches of trees, set as closely as possible on the ground, and laced and bound together. At the same time other workers construct the door frame, which, in appearance, is like a dormer window. Two straight poles, with forked tops, are driven into the ground at the base of and close inside of the doorway timbers, a cross stick is placed in the forks and another on the doorway timbers, at the same level. This provides the basis for a flat roof, the space between it and the apex of the hogan, on the sloping side, being left open for a smoke hole. The sides of the projecting doorway are filled in with upright sticks.

The entire structure is next covered with cedar bark, and earth is then thrown on to a thickness of about six inches, making the hut perfectly wind and water proof. This completes the house. In the building all the proceedings are conducted on a definite, pre-determined plan, and in the order sketched above. No such rigid rules are followed, however, in the construction of summer shelters, usually half-huts, put up on some sloping hillside overlooking fields under cultivation. These temporary shelters are generally constructed on the "lean-to" principle, the roof being covered with straw, corn-stalks, or other available material and finished with earth, or sometimes left unfinished.

With the hogan completed by evening, everything is ready for the dedication. The wife sweeps out the house with a wisp of grass and makes a fire directly under the smoke-hole. She then goes to her bundles which are still outside and procures a quantity of white corn meal, which she pours into a saucer-shaped bowl and hands to the hosteen, or head of the family. Taking it, he enters the hogan and rubs a handful of the dry meal on each of the five principal timbers that form the frame. Beginning at the south doorway timbers he does this successively at the west, north, east timbers, and the north doorway pole, putting the meal as high as he can reach conveniently. While making these "gifts," as the proceeding is called, the man preserves a strict silence, but as, with a sweeping motion of his right hand from left to right, "as the sun travels," he sprinkles the meal around the outer circumference of the floor, he says, in a low chanting tone:

May it be delightful, my house;
From my head, may it be delightful;
To my feet, may it be delightful;
Where I lie, may it be delightful;
All above me, may it be delightful;
All around me, may it be delightful.

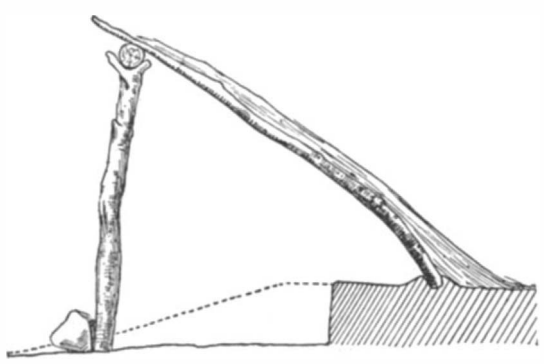
A similar invocation is addressed to the fire, into which a little of the meal is flung, a handful or two is tossed up through the smoke-hole, and two or three handfuls are sprinkled out of the doorway, with other invocations.

The woman also makes an offering to the fire by throwing meal upon it and repeats invocations resembling those of the man. When a hogan is built for a woman who has no husband, or when the husband is absent, the woman herself performs all the ceremonies. This ceremony is called the "salutation to the house."

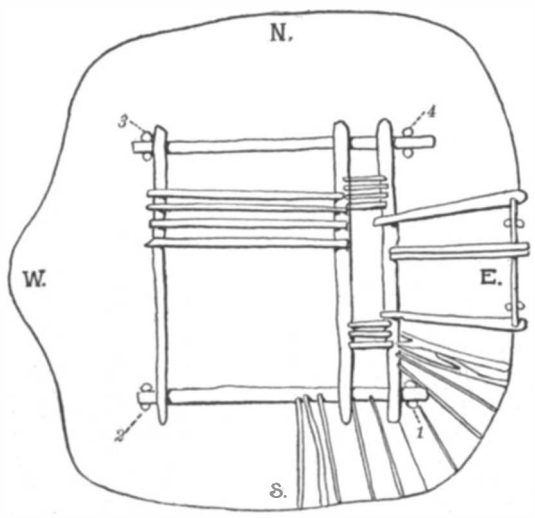
Occasionally on the same evening, but usually after an interval of two or three days, the "house devotions" take place. This ceremony is a more elaborate one, and all the friends of the family from far and near are invited. Although analogous to the Anglo-Saxon house-warming, the house devotions of the Navahos, while serving as an occasion for merry-making to the young people, have a very solemn significance to the elders. If it be not observed soon after the house is built, bad dreams will plague the dwellers therein, toothache, dreaded for mystic reasons, will torture them, evil influences from the north will bring all kinds of bodily ill, the flocks will dwindle, ill luck will come, ghosts will haunt the place, and the house will become an evil thing, tabooed.

For the house devotions arrangement is made with some Katalchi, or medicine man, to come and sing the house songs. For this service he always receives a fee, sometimes a few sheep or their value, perhaps three or four horses, according to the means of the house builder. The songs are sung by all the men present, the medicine man merely leading and directing them. Each one, and there are many of them in the tribe, has

FRAME OF A HOGAN, SEEN FROM BELOW.



SECTION OF A SUMMER HUT.



GROUND PLAN OF YEBITCAI HOUSE.

his own particular songs, differing in minor details from those of others, although of similar import, and after he has pitched the tune, he listens closely to hear whether the exact words are sung. This is a matter of great importance, as the omission of part of a song, or its incorrect rendering, would bring evil, it is believed, to the house and its occupants.

The first song is addressed to the east and is as follows:

Far in the east, far below, there a house was made;
Delightful house.
God of Dawn, there his house was made;
Delightful house.
The Dawn, there his house was made;
Delightful house.
White corn, there his house was made;
Delightful house.
Soft possessions, for them a house was made;
Delightful house.
Water in plenty surrounding, for it a house was made;
Delightful house.
Corn pollen, for it a house was made;
Delightful house.
The Ancients make their presence delightful;
Delightful house.

Immediately following this song, but in a much livelier measure, a benedictory chant is sung, which closely resembles the song of invocation. After an interval a song of similar import is sung to the west.

These two songs are repeated until each one has been sung three times to each cardinal point, the benedictory chant occurring between each song. The songs must be addressed to each of the cardinal points, because, under the Navaho system, different groups of deities are assigned to each of these points.

These songs are known as the "Twelve House Songs," although there are only two of them, each repeated many times. After they are finished, many other songs are sung, to the benignant goddess of the west and to the complimentary goddess of the east, to the sun, the dawn, and the twilight: to the light and to the darkness, to the six sacred mountains, and to many other members of a numerous theogony. Other song prayers are chanted directly to malign influences, beseeching them to remain far off; to evil in general, to coughs and lung evils, and to the sorcerers, praying them not to come near the dwelling. The singing is so timed that the last song is delivered just as the first gray streaks of dawn appear, and the visitors round up their horses and ride home.

It frequently happens that, in spite of the ceremonies that have been performed, malign influences affect the new dwelling. The inmates suffer from sore eyes or toothache, or bad dreams trouble them, or ghosts are heard in the night. The house ceremony is then repeated. If, after this, the bad conditions still prevail, or bad omens are noted, recourse must be had to a very elaborate ceremony, the dance of the Yebichai. For this ceremony a separate structure must be erected, much more elaborate than the regular hogans. It is a flat-roofed hut, called in the Navaho tongue inyadaskuni, literally "under the flat." The roof is nearly square, as well as flat, and the shape suggests a truncated pyramid, but as it is covered with earth heaped over the entire structure, it is externally little more than a shapeless mound.

When the Yebichai ceremony is in progress, the hut is occupied by the medicine man and his assistants, and by the young men who assume the sacred masks and personate various deities in an elaborate series of nightly dances. In the mornings the medicine man sits under the western side of the hut and directs the young men in the process of sand painting, the making of curious sand mosaics delineating mythologic subjects. No special reverence attaches to these structures, except when a ceremony is in progress. They are not held to be the exclusive property of any particular person or persons, but are for the use of the neighborhood. When not otherwise occupied, the inyadaskuni may be used as a traveler's house, or for any other purpose. Indeed, the women often erect their vertical blanket looms there and use the place as a work room, but it is rarely used as a dwelling in winter, as it would have to be vacated whenever needed for the Yebichai.

Congresses at Paris.

Among the numerous congresses which are to be held this year in Paris in connection with the Exposition, the following list includes the principal subjects and dates, and will, no doubt, be found convenient for reference:

June	8–12.	Congress of Stock Companies.
	18–23.	Mines and Metallurgy.
	25–30.	Accidents to Workmen and Insurance.
	25–30.	Aeronautics.
July	8–11.	Commercial Travelers and Representatives.
	9–13.	Automobiles.
	9–13.	Strength of Materials; Methods of Testing.
	16–18.	Steam Apparatus; Surveillance and Security.
	19–25.	Applied Mechanics.
	23–28.	Commerce and Industry.
	23–28.	Photography.
	23–28.	Proprietary Rights, Trademarks, etc.
	23–31.	Applied Chemistry.
	27–Aug. 1.	Electricity as Applied to Medicine; Radiography, etc.
	28–Aug 3.	Navigation.
	30–Aug. 4.	Architects.
	30–Aug. 4.	Custom House Regulations.
Aug.	6–11.	Chemistry.
	6–11.	Technical, Commercial, and Industrial Education.
	6–11.	Mathematics.
	6–11.	Physics.
	16–18.	Bibliography.
	18–25.	Electricity.
Sept.	3– 5.	Gas.
	20–29.	Railroads.

Success of the Parcels Post.

The parcel post systems for conveying small packages between New York and Germany is very successful. The system has been in operation since October 1, 1899, and it was tried as an experiment. According to the terms of agreement, it was to continue in force until terminated by mutual agreement, and can be annuled upon six months' notice by either country. The parcels post system is in force between the United States and eighteen countries, but the volume of mail exchanged is small, and the business with Germany is larger than all the others combined. Packages are sometimes as long as 6 feet in length and girth combined, 11 pounds is the limit in weight. The Germans have been quick to appreciate the advantages of the system. The number of parcels post packages dispatched and received from Germany, October, 1899 to June, 1900: Dispatched—pieces, 6,461; bags, 350; registered bags, 484. Received—pieces, 10,320; bags, 465; registered pieces, 950; registered bags, 67. Total pieces handled, 16,781.

The Government Work for Good Roads.

The work of the Office of Public Road Inquiries, under the direction of Gen. Roy Stone, has been marked during the past year by steady progress along its well-established lines. A great deal of work is accomplished by correspondence and by the gathering and disseminating of important information relating to various phases of the road subject. Many thousand copies of "good roads" literature have been distributed among farmers and other persons interested, and important road conventions have been attended by representatives of the Office, and many State legislatures have asked for and received assistance in framing new road legislation. Examples of steel road tracks have been completed in a number of different localities, and these experimental sections of steel road clearly demonstrated their usefulness for the Western States and for other places which are but sparingly supplied with good stone and gravel. When steel becomes cheap once more, the manufacturers can take the matter up and make a series of special shapes. The object lessons furnished by sample roads have been extensive, and sections have been built in several parts of the country. As a result of the investigations, the Office considers that for local needs as well as for our material development and prosperity a well-regulated system of public roads through the whole country is, day by day, becoming more necessary. While we have the most perfect railway system in the world, our public highways are and always have been inferior to those of any other country in the civilized old world. As our public roads are the veins and arteries of our agricultural, commercial, and social life, they are not yet receiving the consideration that their great importance deserves. Much has been done in the United States toward road building during the last few years, but much more needs to be done.

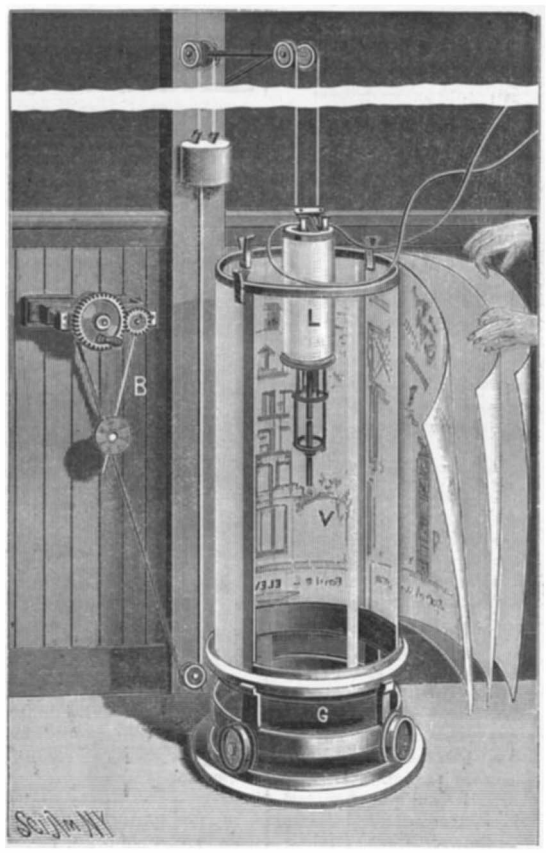
REPRODUCTION OF WORKING DRAWINGS.

In the industries, there is a constant need of quite a large number of copies of drawings. In the building of an engine, for example, every piece is the object of a separate drawing that must be placed in the hands of the workmen who are to take part in its production. The original drawing would be quickly destroyed were it to pass in succession through the various shops, and it would be still worse with tracings, which it costs considerable to make. It has, therefore, become customary to make hasty photographic reproductions called "blue prints." For this photographic operation, neither camera nor objective is used. The drawing is traced, and the tracing serves as a negative. The printing is done in a frame through simple exposure to light, as in ordinary photo-copying. The paper used is sensitized with salts of iron, which are cheaper than those having silver as a base. The papers most widely used are those prepared with red prussiate of potash and ammoniacal citrate of iron. The solution is spread over the paper and allowed to dry in darkness. After exposure to sunlight under the negative, it suffices to wash the print with a large quantity of water in order to cause the drawing to appear in white lines upon a blue ground. The manipulation is, therefore, very simple, and so such paper is manufactured in large quantities for use in the industries. There are, moreover, varieties of which the composition is a little more complicated than that of the kind we have just mentioned, and which are more sensitive and require a shorter time of exposure. It will be readily understood, in fact, that in large manufacturing establishments rapidity of printing is a factor to be taken into consideration, and that, in winter, the want of sufficient light often causes much inconvenience. Besides, frames are always cumbersome and expensive, and become quickly deteriorated, since they are often handled without much care and are exposed to humidity as well as to the mid-day sun. In certain works, the electric light is used; but the ordinary flat frames do not lend themselves well to this kind of printing.

In the Panhard establishment, so celebrated for its automobile carriages, a very large number of blue prints is required, more than two hundred a day sometimes being made for the use of the different shops. As these must be made whatever be the state of the atmosphere, the house uses the electric light exclusively, but along with it an interesting apparatus of English manufacture that permits of easily turning out daily the number of prints above mentioned.

This apparatus consists of a cylinder, *V*, formed of two semi-cylindrical sheets of thick glass mounted in a metallic frame. The whole rests upon a base, *G*, provided with wheels that roll upon a circular rail. The tracing of the drawing to be reproduced is applied against the exterior surface of the glass cylinder and over it is placed the sensitized paper. The whole is then surrounded with a cloth which is fastened tightly with buckles. In the interior of the cylinder, is suspended an electric lamp which serves as a weight for actuating a simple clockwork mechanism, *B*, fixed to the wall. After the card has been wound around the drum of the mechanism and the drawings have been put in place, the pendulum is set in motion, and the lamp, *L*, then gradually descends in the cylinder, thus lighting the entire surface uniformly. The lamp is made to move more or less quickly, according to the degree of translucency of the tracing and the sensitiveness of the photographic paper, by regulating the position of the pendulum bob. It may also be made to travel up and down a second time if it is found that the impression is not sufficient.

The lamp employed operates with 10 amperes, and 120 volts. Two sheets of paper, 29·52 × 41·33 inches, are



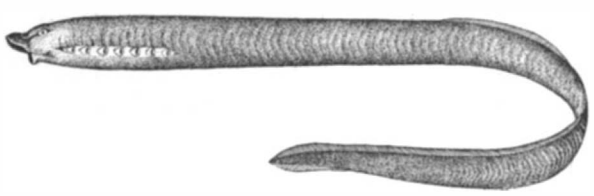
APPARATUS FOR PRINTING WORKING DRAWINGS.

printed at the same time, and forty prints can be made per hour. For the foregoing particulars and the illustration, we are indebted to La Nature.

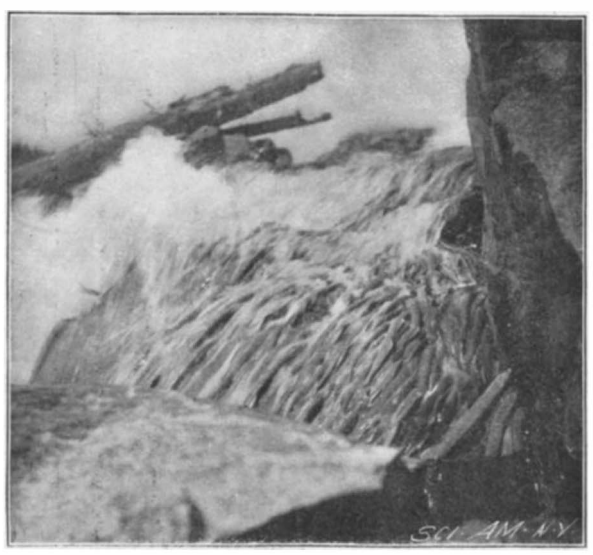
THE THREE-TOOTHED LAMPREY.

BY HUGH M. SMITH.

The fascinating pastime of photographing living animals is now receiving an unusual amount of attention and is contributing not a little to a knowledge of their habits and peculiarities. A class which has great attractions, and at the same time presents special difficulties is the fishes, which have been made the subject of recent photographic experiments in the United



THREE-TOOTHED LAMPREY.



LAMPREYS ASCENDING WILLAMETTE FALLS, OREGON.

States and Europe. Most of the camera studies of fishes have necessarily been addressed to fish in aquaria, as the opportunity rarely presents itself for getting satisfactory views of fish in a wild state. How many really good photographs of fish in the native waters have been made?

Some years ago, while fishing for salmon at the Falls of the Willamette River, near Portland, Oregon, the writer was able to take an instantaneous view of a group of curious fish-like animals which were endeavoring to surmount the falls; these were three-toothed lampreys, and the photograph is here reproduced.

The three-toothed lamprey (Entosphenus tridentatus) which is called "eel" everywhere on the west coast, inhabits the waters of the Pacific States from the Aleutian Islands to Southern California, and is a large anadromous species, especially abundant in the basin of the Columbia River. It is not eaten, but is considered a good bait for sturgeon, and was at one time extensively used for this purpose.

The lampreys in spring and summer ascend the Columbia in large bodies, and push their way to the headwaters of many of the tributaries for the purpose of spawning, many being then caught in salmon wheels. The furthest point to which they have been known to migrate is Lower Salmon Falls, Idaho, on the Snake River, 1,000 miles from the ocean. They are frequently seen at falls, dams, and other obstructions, which they assiduously endeavor to surmount, clinging to the rocks and so engrossed with their efforts that they are oblivious to the presence of man and may be picked off by hand.

In June, 1894, the rocks in the particular part of the Willamette Falls where the salmon are wont to ascend were at times completely covered with large-size lampreys. In places where the force of the water was least, they formed a slimy, wriggling mass several layers deep, and at a short distance the rocks looked as though covered with a profuse growth of coarse seaweed. A lamprey dislodged by the current or by an angling rod, or forced to give up its hold by exhaustion, would sometimes carry half a dozen others with it to the bottom of the falls. At the side of the cascade, where the rocky walls were quite steep, numbers of lampreys, to avoid the current, had drawn themselves entirely out of the water or remained hanging from the rocks with only their tails in the water; some of these are shown in the engraving. In the turbid water beneath the falls hundreds could be seen trying to secure a position on the rocks, some being those which had been swept down in previous attempts and some fresh arrivals from salt water. This noteworthy run had been in progress for about a week. It seemed to the writer that only a very small part of the run could ever surmount these falls, over which salmon must have been able to pass with the greatest difficulty. The bodies of many of the lampreys showed the effects of their trying ordeal; the posterior part of some of them was worn off fully one-fourth the body length by being whipped against the rocks while their heads remained fixed; and numbers were seen to lose their hold and float away, emaciated, covered with ulcers and fungus, and apparently dead. During a number of hours, not more than two or three were seen to reach the crest of the falls and disappear over the edge.

The upward progress of the lampreys was accomplished by fastening themselves to the rock by means of their suctorial mouth and gradually working their way upward by loosening their hold for an instant while propelled by a sudden springing movement of the body. In the face of such a torrent of water, their upward course was necessarily very slow, as their hold on the rocks could be relaxed for only the briefest period.

Associated with the species are the names of a number of persons prominent in the early exploration of the great Northwest. The first specimen known to science was obtained at the Falls of the Willamette about 1830, by Dr. Meredith Gairdner, an employee of the Hudson Bay Company at Fort Vancouver (Wash.), whose manuscript description of the species was published by Sir John Richardson in 1836. About 20 years later, Dr. Charles Girard, the ichthyologist of the great Pacific Railroad surveys, redescribed the species from Astoria, naming it in honor of John Jacob Astor.

The Current Supplement.

The current SUPPLEMENT, No. 1267, has as a frontispiece a view of the foyer of the Théâtre Français at Paris. "The Facilities Afforded by the Office of Standard Weights and Measures for the Verification of Electrical Standards and Electrical Measuring Apparatus" is an important paper. "A Simple Illumination Photometer" gives working drawings. "The German Antarctic Expedition" is a very full paper.

Contents.

(Illustrated articles are marked with an asterisk.)

Aeronauts, prize for..... 228
Automobile in war..... 230
Automobile news..... 230
Blunder, geographic..... 229
Commerce and industry, department of..... 226
Drawings, perspective apparatus for*..... 228
Drawings, reproduction of working*..... 235
Electrical notes..... 231
Engineering notes..... 231
Gordon Bennett cup race*..... 228
Grain, water transportation of*.. 232
Gun, Colt*..... 229
Inventions, index of..... 236
Inventions recently patented.... 236
Lamprey, three-toothed*..... 235
Mivart, death of St. George 227
Motor carriage racing*..... 229
Navahos, houses of*..... 233
Notes and queries..... 236
Parcels post, success of..... 234
Paris, congresses at..... 234
Paris Exposition..... 227
Planters, attachment for*..... 228
Prizes, French..... 227
Ramapo contract..... 226
Roads, good government work for..... 235
Science applied in modern war.. 227
Science notes..... 231
Supplement, current..... 235
Turrets of the "Kearsarge."* 225, 230
Turret system, double..... 226
War, cost of Chinese..... 229
Water supply, New York's..... 226

RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

CORN-HARVESTER. — Wilson Howard, Belvidere, Kans. The harvester is made to harvest corn in one or two rows, as may be desired, so that the moment the horse ceases to pull or the driver leaves his seat, the knives are automatically carried beneath a platform. They cannot, therefore, come in contact with any object which the harvester may strike. The machine is thereby rendered safe while at rest, and the knives are at the same time protected.

SICKLE-BAR.—William H. and Oliver F. Brusman. Elkhart, Ind. The sickle-bar is provided with interlocking knives and with a lever, one end of which presses against one side of a knife in the longitudinal direction of the bar. A spring extension held stationary allows the lever to yield upon expansion or contraction or wear of the knives. The knives are securely held in place without the use of rivets, screws, or the like. All lost motion due to expansion and contraction or wear of the knives or cutter-sections is taken up.

CHECK-ROW ATTACHMENT FOR CORN-PLANTERS.—Martin B. Bennett, Boyden, Iowa. This check-row attachment is capable of being applied to any corn-planter, and is operated from the axle of the planter. Two markers are provided at each side of the machine, one of the markers being adapted to indicate where the hills of corn are dropped, and the other to indicate whether the planter is dropping in line with the rows previously planted. Should the planter begin a deviation from the marks of the previous round, the driver can instantly correct the deviation and bring the markers to correct position.

GRAIN-BINDER.—Alexander G. McIntosh, Atalissa, Iowa. This invention is a grain-binder in which the inventor has very ingeniously adapted the ordinary reciprocal needle and rotating shuttle to the work of tying the knot in the sheaf-band. The mechanism is thrown out of gear by a modification of the Appleby clutch, and the grain is advanced to the table, where the gavel is formed by a swinging divider-arm. The gavel is then advanced to position at the needle and shuttle, constituting the knotter. Here the knot is tied and the sheaf expelled. By a rearrangement of mechanical elements, previously known, the inventor has succeeded in producing a comparatively simple and effective machine.

Electrical Apparatus.

ELECTRIC BELL.—Francis and Henry F. Keil, Bronx, New York city. The object of this invention is to provide a bell so constructed that the armature can be turned away from the electromagnet and the contact-pin when it is desired to clean or adjust the spring-contact. Simple means are provided for holding the dust-cap removably in place over the magnet and armature, as well as a method for attaching the hammer-stem to the armature.

VESSEL INDICATOR. — Arthur L. McCormick, Port Huron, Mich. To provide a means for ascertaining at any moment the draft and level of a vessel during loading or unloading, is the purpose of the invention. Upon a drum, spring actuated in one direction, a rope or other flexible connection is wound. A commutating wheel is connected with and moves with the drum. Two contact-springs bearing insulation on opposite sides make alternate contact with the commutator-wheel according to the direction of the movement. A retarding fly-fan is geared to the drum to reduce fluctuations. A double-acting step-by-step electric indicator is provided, worked in opposite directions by the electrical contacts alternately brought into action by a float,

Mechanical Devices.

CIGAR-BUNCHING MACHINE.—James H. Hoefler, Ashland, Ohio. The machine belongs to that class in which the bunch is manipulated by an apron or belt, which is connected with a sliding table, so that as the table is moved the belt serves to roll or shape the bunch. The cigar-machine has a bunch-disposing roller, comprising a roll proper. On the roll, heads are mounted, one of which heads is loose. Flexible rods are extended between and are carried by the heads. The loose head can be locked in one of two positions.

VALVE-GEAR FOR PNEUMATIC COTTON-FEEDERS. — George W. Williams, Waco, Tex. The special object of this invention is to provide means for operating the air-blast, by which means the valve can be held in one position longer than in the other, thus adapting it to a battery of elevators formed in divisions operating alternately. In these divisions there are unequal numbers of elevator sections, whence it follows that in one division the air-blast must be applied longer than in the other.

VENDING-MACHINE. — Gustavus F. Brown, Manhattan, New York city. The invention provides a cast-metal merchandise receiving and dispensing device which dispenses the merchandise by a pulling or drawing action applied to a plunger instead of by the usual pushing action. The machine quickly responds to proper manipulation, is positive in its action, and comprises comparatively few parts, each of which can be renewed when broken or worn. A double coin-chute is provided, each section of which has independent connection with adjoining dispensing mechanism.

WRENCH.—Phineas R. Coleman, Newark, N. J. This wrench comprises pivotally-connected jaws and means whereby, through the medium of a slide, the jaws can be quickly adjusted to and from each other by the use of one hand and locked in adjusted position.

FUR-CUTTING MACHINE.—John Derbohlaw, Brooklyn, New York city. This machine is particularly adapted for the use of hatters. Connected with a cutting mechanism is a movable nap or hair support arranged on the feed side to carry the hair away from the cutting mechanism. An operative connection is provided between the cutting mechanism and the hair-support, so that both will move in unison. The machine not only cuts the fur but also preserves all the hair intact, so that it will be available for the manufacture of felt and the like. As the fur is fed slowly, the hair is brushed back and the rapidly-reciprocating knives cut the fur alternately without injuring the hair.

CONSECUTIVE-NUMBERING MACHINE. — Oswald G. Bartusch, Brooklyn, New York city. In numbering machines having movable cipher-sections it was hitherto necessary when printing numbers in the cipher-scale for the pressman to set the cipher-section of all the numbering-wheels except the units-wheel in a non-printing position by hand before starting the press, as otherwise the numbering would start with "0001" instead of 1. When printing the numbers in the reverse scale the pressman had to move the cipher-sections successively into a non-printing position. It was necessary to stop the press for all these operations. With this improvement, the character-numbers without the addition of superfluous ciphers can be printed in both ascending and descending scales, without stopping the press for making the ciphers disappear at the proper moment.

Miscellaneous Inventions.

FLY-TRAP.—Charles E. Varnum, Vinland, Kans. The invention provides a very ingenious construction through which cows and other animals can pass and by which the flies on the cows are brushed off into traps which are arranged to be removed and replaced. The apparatus is portable or fixed.

POCKET-KNIFE.—Mark L. Heath, Jasper, Colo. The object of the invention is to provide a pocket-knife with means for securely locking the blades in open or closed position. A bolt is mounted to slide longitudinally in the knife-casing and adapted to engage the fulcrum end of the blade and lock the blade either in open or in closed position. An abutment for the bolt is mounted to move at an angle to the bolt and is adapted to engage and to lock it against return movement.

RECEPTACLE OR CAN.—Joseph T. Mills, Brooklyn, New York city. The can or receptacle is provided with cushions at its sides and bottom, so arranged that the receptacle can be subjected to hard usage without injury. By using cushioned frames or supports, ash-cans, and milk-cans can be handled as one piece with their frames.

RAZOR GUARD.—Terence F. Curley, 6 Warren St., New York city. The guard comprises a spring clamping-frame for removable connection with the razor-blade, on which frame a guard-bar is mounted to slide. A screw is mounted to turn in the frame and screw in the guard-bar, to move the latter across the face of the blade. The device is simple and durable. The frame, and with it the guard-bar, can be readily placed in position with the blade, or removed whenever it is desired to clean or sharpen the blade.

NON-REFILLABLE BOTTLE. — James A. Higgs, Bearspring, Tenn. The inventor has endeavored to provide a bottle which cannot be refilled. A valve is inserted in a peculiar manner in the neck of the bottle so that it cannot be removed. The valve is designed to prevent the refilling of a bottle, and yet, to permit the outflow of liquid. All parts are made of glass.

INVOICE-SHEET.—Charles Lohrman, Brooklyn, New York city. An invoice-sheet is provided by this invention which, when used with a carbon-sheet or other duplicating medium, a tag and receipt can be written and an envelop addressed at the same time. The invoice-sheet is especially adapted for use in connection with a manifolding-machine for which a patent has been applied by the inventor.

DISINFECTING DEVICE.—Lewis F. Longmore, Lowell, Mass. The invention is an improvement in that class of disinfecting bodies which are adapted to contain a disinfectant and to emit it in the form of a vapor and which are used to protect fowls from vermin. The invention provides a simple device of this nature in the form of a nest-egg. The device contains an absorbent designed to hold the disinfectant.

VEHICLE-SEAT.—James Burns, Cincinnati, Ohio. Improvements in the structure of vehicle-bodies, including the bodies of automobiles have been devised, the improvements relating specifically to a new arrangement of seat devices. The arrangement is especially intended for use in connection with a running-gear devised by the same inventor. Ratchet-plates are attached to the side walls of the body, with which ratchet-plates studs attached to a seat coact, in order to hold the seat in any desired position.

SPECTACLE OR EYEGLASS MOUNTING.—Myron C. Thomas, Waverly, N. Y. This invention provides various improvements in spectacle and eyeglass mountings, whereby the lenses are securely held in place in the frame, and a fine neat appearance is given to the article.

CAP.—Samuel M. Blumenfield, Manhattan, New York city. The cap is designed for the use of bicycle-riders and is arranged to permit a thorough circulation of air to keep the head and forehead cool. While possessing the desired stiffness to maintain its proper shape, it is so pliable that it readily conforms to the shape of the head of the wearer. It can be folded so as to be carried in the pocket.

WAISTBAND. — Louis Zazeela. Brooklyn, New York city. The buttonholes, in this waistband, when cut, need not be worked at their edges as usual, because they are reinforced and protected by strips of a stouter material than that of the band, each reinforcing or protecting strip having a buttonhole cut therein which registers with a buttonhole in the band. The invention provides especially for the protection of buttonholes in what is known as "pocketing" goods.

COMPOUND FOR COATING INCANDESCENT MANTLES.—Albert S. Newby, Chanute, Kans. The coating is composed of ether, alcohol, gun cotton, and glycerin. It possesses the advantage over coatings at present in use of not distorting the mantle when drying, of strengthening the mantle by toughening the ash, and increasing the light-giving power 25 per cent.

Designs.

PULLEY-CASE. — Henry A. Frost, Manhattan, New York city. The cheek-pieces are flat, with convex front faces, and are provided with interlocking members at top and bottom. At the rear end the cheek-pieces are connected by a loop.

Note.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

Business and Personal.

Marine Iron Works. Chicago. Catalogue free.

"U. S." Metal Polish. Indianapolis. Samples free.

Yankee Notions. Waterbury Button Co., Waterb'y, Ct.

Megaphone Calendar free. Crane Bros., Westfield, Mass.

Gear Cutting of every description accurately done. The Garvin Machine Co., Spring and Varick Sts., N. Y.

Ferracute Machine Co., Bridgeton, N. J., U. S. A. Full line of Presses, Dies, and other Sheet Metal Machinery.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4. Munn & Co., publishers, 361 Broadway, N. Y.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(7857) W. H. M. writes: I take the liberty to ask you if you can favor me with the receipt to make elastic mucilage cement, this comes in square sticks about 2½ inches long. A. Fine pale glue 1 pound, dissolve over a water bath in sufficient water, add brown sugar ¼ pound, continue the heat until the mixture becomes homogenous; pour on a slab of slate or marble, and when cold cut into squares.

(7858) S. D. P. asks if there is any material in liquid form, that remains liquid at atmospheric pressure and temperature. that is magnetic? A. We do not know any such liquid as you describe. The only magnetic substance in the liquid form is liquid oxygen. The temperature of this is nearly 300° below zero.

(7859) J. B. asks: 1. Will you please let me know the price of the Chemiker Kalender? A. We are not able to give you the price of this book. 2. Do you know of any book of tables in English giving recently discovered physical data and constants, such as boiling points, specific gravity of gases, thermo-chemical data, data pertaining to the liquefaction of gases, in fact a modern pocket book of chemical physics? Will you please send me your book catalogue? A. The Smithsonian Physical Tables are the most complete of any in English upon the topics pertaining to gases, etc., for which you ask information. 3. A New York paper describes a combination process of Prof. Pictet and certain New York inventors for separating the gases of the atmosphere. Will you please describe this combination process clearly in the Scientific American? A. An article concerning the method of separating the gases of the atmosphere, as devised by Pictet, was published in the Scientific American of March 31, 1900.

(7860) O. M. S. asks: What is the best and easiest way to make an induction coil for six one quart cells bichromate battery and what is the best size and how much of insulated copper wire? A. You can run a very large coil with even four cells of bichromate battery, one giving an eight or ten inch spark. You will find in our Scientific American Supplement, No. 160, a description of a coil giving a spark of 1½ inches, and in Supplement, No. 1124, a coil of 6 inch spark. Price of these papers, ten cents each.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Issued for the Week Ending

APRIL 3, 1900,

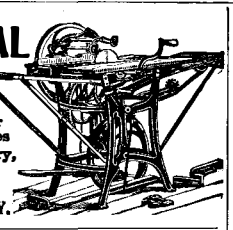
AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Abrading cylinder, J. R. Thomas 646,511
Acid and making same, naphthazarin sulfo, R. Bohn 646,795
Acid, phenol ether of guinin carbonic, A. Weller 646,631
Adding machine, G. W. Chapin 646,599
Adhesives, making, C. Brueder 646,724
Adjustable table, Finnegan & Melton 646,657
Advertising device, Heiron & Toffelmier 646,432
Air box, self cleaning fresh, G. Cody 646,535
Air brake, C. E. Morgan 646,447
Air or other liquid gases, portable vessel or bottle for holding and shipping liquid, J. F. Place 646,459
Alarm. See Burglar alarm.
Alarm handle, C. W. & A. Mettler 646,749
Alloy of aluminum and magnesium, L. Mach 646,442
Ammunition, feed strip for fixed, Benet & Mercie 646,792
Annunciator and spring jack, W. D. Gharky 646,693
Annunciator and spring jack, combined, E. E. Clement 646,676
Apron, apparel, W. M. Memminger 646,748
Atomizer spray tube, H. M. Dunlap 646,491
Auger, well, J. Habn 646,538
Automobile steering gear, W. L. Crouch 646,728
Awning operating mechanism, W. Johnson 646,838
Axle, lubricating, W. H. Hoell 646,830
Axle, vehicle, A. Cunningham 646,571
Bag. See Caddie bag.
Bag fastener, J. H. Kirkland 646,602
Bag holder, J. U. & R. F. Reser 646,762
Bails to sheet metal vessels, attaching wire, G. W. Knapp 646,741
Bait or spinner, spoon, E. F. Pflueger 646,916
Bale of cotton, etc., P. K. Dederick 646,521
Baling press, P. K. Dederick 646,520
Ball. See Toy ball.
Bath cabinet, A. C. Floyd 646,572
Bath cabinet, hot air or vapor, Lennon & Whaley 646,580
Battery. See Galvanic battery. Storage battery.
Battery elements, cellulose envelop for storage, E. A. Sperry 646,923
Bearing, thrust, H. Wyss 646,782
Bearings, valves, etc., material for, I. Kitsee 646,917
Bed bottom, spring, J. F. Gail 646,659
Bed slat, C. V. Lively 646,542
Bed spring, adjustable, Holder & Adney 646,831
Belt shifting mechanism, pneumatic, J. Woodberry 646,892
Bicycle, H. H. Fefel 646,656
Bicycle attachment, C. H. Bemenderfer 646,791
Bicycle brake, M. Fesler 646,818
Bicycle brake, J. C. Hauger 646,431
Bicycle brake, P. W. Pratt 646,546
Bicycle saddle, G. A. Ross 646,919
Bicycle wheel, C. O. Stehfest 646,765
Bill carrying apparatus, mechanical, A. W. Thierkoff 646,509
Binder, wire, G. D. Foster 646,819
Bit. See Expansible bit.
Blind and brace connector, E. R. Gambell 646,423
Bobbin holder, T. J. Murdock 646,625
Boiler. See Steam boiler.
Boiler brackets, making wrought metal, H. L. Wilson 646,777
Boiler tube stopper, C. S. Clark 646,804
Book rest or table, W. H. Jackson 646,835
Boot or shoe patterns, machine for outlining and grading, L. & L. E. Cote 646,415
Bottle, E. Glaeser 646,660
Bottle cap, F. Recht 646,627
Bottle neck forming machine, A. J. Rudolph 646,874
Bottle neck forming tool, P. Lindemeyr 646,847, 646,848
Bottle neck forming tool, H. R. Loper 646,851
Bottle necks, etc., tool for forming, P. Lindemeyr 646,849, 646,850
Bottle stopper, J. S. Alston 646,653
Bottle washer, B. V. Nordberg 646,604
Box. See Air box. Feed box. Miter box. Packing box. Paper box. Wagon box.
Brake. See Air brake. Bicycle brake. Car brake. Carriage brake. Vehicle brake. Wagon brake.
Brake actuating mechanism, Emery & Wishart 646,814
Brake shoe, J. P. McIntyre 646,451
Branch or lamp switch, E. Liebscher 646,744
Building construction, T. O'Shea 646,503
Building construction for floors and ceilings, T. O'Shea 646,502
Bunsen burner, C. M. Kemp 646,840
Burglar alarm, A. S. Gensler 646,551
Burner, See Bunsen burner. Gas or vapor burner.
Burning coal dust, apparatus for, G. Hilliger (reissue) 11,816
Button, A. L. Sprague 646,884
Button cleaning device, H. A. Deiters 646,896
Button drilling machine, S. P. MacCordy 646,647
Button fastening device, W. A. De Long, Jr 646,416
Button, separable, D. J. Sinclair 646,468
Cabinet, spool, W. H. Gentner 646,424
Caddie bag, H. H. Perkes 646,869
Cake pan, W. B. Mumford 646,529
Calendar, M. O'Marra 646,457
Camera, magazine, Balch & Merrill 646,788
Can. See Milk can. Oil can.
Can capping machine, C. W. Sleeper 646,469
Can filler, Taylor & Gudridge 646,508
Cans, die for forming lock seams in key opening, C. W. Sleeper 646,763
Canning apparatus, fruit or vegetable, A. Compton 646,518
Canceler, registering stamp, Jenkins & Vaughn 646,531
Canceling machine, stamp, C. Walker 646,773
Cane stripper and cleaner, J. B. House 646,908
Car brake, C. V. Rote 646,609
Car controller, electric railway, A. Sundh 646,889
Car controlling apparatus, electric railway, A. Sundh 646,768
Car door, freight, L. H. Harrison 646,644
Car, freight, W. T. Manning 646,441
Car label holder, railway, T. W. Geary 646,600
Cars or vessels, cooling and ventilating attachment for, G. A. & R. F. Dunn 646,522
Carbon brush, E. Thomson 646,476
Carbon sheet, C. H. Bailey 646,566
Carbureter, W. H. Wood 646,780
Card holder, J. Chelimer 646,726
Carriage brake, McLoughlin & Schmidt 646,501
Carriage driving gear, motor, R. E. Twyford 646,477
Cart, P. A. Hoven 646,833
Case. See Packing case.
Cash or article cushion, E. M. Knight 646,525
Cash register, E. F. Spaulding 646,564
Cask sweetening apparatus, C. Lampitt et al 646,438
Caster, furniture, G. D. Clark 646,570
Cell, storage, H. J. Cogswell 646,894
Cellulose, producing solutions of, E. Bronnert 646,799
Chuck, tool, J. L. Cook 646,489
Churn, K. W. Hargrove 646,430
Chute, coal, J. W. Cocherell 646,930
Circuit closer, track, S. L. Neely 646,454
Circuit protective device, W. D. Gharky 646,691
Clamp. See Pipe clamp. Spring clamp.
Clamp, T. Dickman 646,809
Clasp, M. Rubin 646,561
Clothes line holder, C. E. Cole 645,412
Coating applying apparatus, W. L. Allen 646,616
Cock, stop, J. Regar 646,707
Cock, stop and waste, S. M. Levy 646,440
Cocks, means for automatically opening or closing gas, Mather & McCallum 646,446
Coffee or tea pot, T. Rossbach 646,461
Collar folding and shaping machine, turn down, W. A. Zeidler 646,784
Comb. See Currycomb.
Compasses, caliper, Young & Ryan 646,783
Concrete mixer, H. Miscampbell 646,544
Condiment holder, M. L. Hansen 646,734
Conveyers, mouthpiece for pneumatic, H. A. Deery 646,490
Corset, M. T. Dodds 646,685
Couch, box, Smallwood & Sulse 646,470 646,471, 646,921
Coupling. See Hose or pipe coupling. Stovepipe coupling. Thill coupling.
Coupling device, C. F. C. Edholm 646,813
Crusher. See Rock crusher.
Cupolas, apparatus for injecting steam into, G. L. Morton 646,448
Curling or crimping iron heater, G. G. Travers 646,891
Currycomb, C. F. Laflin 646,845
Curtain raiser, W. J. Snyder, Jr 646,882
Cushion. See Cash or article cushion.
Cut off, cistern, G. S. Stuart 646,888
Cutter. See Flue cutter. Paper cutter. Pea vine or clover cutter.
Cycle driving gearing, J. H. Mantel 646,581
Dark room, portable, Quatsoe & Beier 646,585
Digger. See Potato digger.
Disinfecting apparatus, M. Sheridan 646,611
Display map or chart, E. Aberli 646,549
Display rack, jewelry, C. L. Watson 646,630
Distilling petroleum, J. A. Dubbs 646,639
Door check, S. Coombs 646,806
Door closer, G. J. Adam 646,720
Door fastener, W. Doyle, Jr 646,810
Door fastener, Norton & Taylor 646,456
Door holder, Chritton & Goodner 646,517
Door stop, F. E. Beatty 646,533
Dredge, hydraulic, S. C. Swarts 646,769
Drill. See Grain drill. Radial drill.
Drill head, Niel & Bonnett 646,752
Dumping and elevating machine, T. Bickerman 646,487
Dust guard, W. M. Ryan 646,462
Dye and making same, acid rhodamin, H. A. Bernthsen 646,794
Dye and making same, black azo, O. Sohst 646,711
Dye and making same, green, R. Bohn 646,796
Dyes, making sulfur, A. F. Poirrier 646,873
Educational appliance, H. Hanstein 646,661
Egg beater, T. Holt 646,736
Egg timer, H. Clayton 646,805
Electric controller, J. C. Lincoln 646,526
Electric current from one conductor to another, device for shifting, W. D. Gharky 646,688
Electric heater, G. S. Knox 646,911
Electric lighting systems, service switch for, G. O. Kelly 646,839
Electric transformer, W. S. Moody 646,500
Electricity, machine for generating and utilizing static, Dodd & Struthers 646,418
Elevator. See Hydraulic elevator. Pneumatic elevator.
Elevator, G. H. Reynolds 646,916
Elevator electrical indicator, Baker & Kip 646,721
Elevator power attachment, hand, E. B. Everingham 646,900
End gate fastening, J. O. Lefevre 646,743
Engine. See Rotary engine. Steam engine.
Engine igniter, gas, O. Owens 646,867
Engine indicator, steam, W. Houtaling 646,700
Engine stop motion, H. F. Crickler 646,636
Envelop, H. M. Cutler 646,638
Envelop feeder, W. J. Bulman 646,801
Eraser, C. C. Gerry 646,824

(Continued on page 237.)

WOOD or METAL Workers



Without Steam Power should use our Foot and Hand Power Machinery. Send for Catalogues
A—Wood-working Machinery,
B—Lathes, etc.
SENECA FALLS MFG. CO.
695 Water St., Seneca Falls, N.Y.

AMERICAN PATENTS.—AN INTEResting and valuable table showing the number of patents granted for the various subjects upon which petitions have been filed from the beginning down to December 31, 1894. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 1002. Price 10 cents. To be had at this office and from all newsdealers.

ENGINE & FOOT LATHES. MACHINE SHOP OUTFITS. TOOLS AND SUPPLIES. CATALOGUE FREE. SEBASTIAN LATHE CO. 120 CULVERT ST. CINCINNATI, O.

Foot and Power and Turret Lathes, Planers, Shapers, and Drill Presses. SHEPARD LATHE CO., 133 W. 2d St., Cincinnati, O.

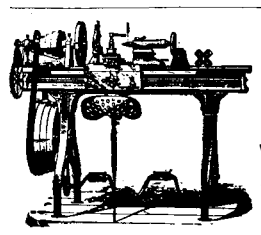
IF NOT! WHY NOT?

If you do not hold a responsible, high salaried position, it is because those above you have made a study of their business. We have sent thousands of young men and women to prosperity who have studied between times through our thorough course of

EDUCATION BY MAIL

in Electrical, Mechanical, Steam, Mining and Civil Engineering; Metallurgy, Art, Architecture, Practical Newspaper Work, English Branches, Stenography, Machine Design and Mechanical Drawing. Low price; easy terms. Mention subjects interested in when writing to

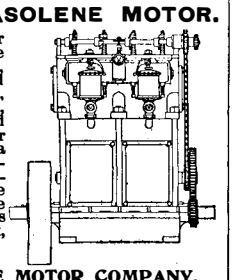
The United Correspondence Schools,
158 Fifth Avenue, New York,
for catalogue No. 33.



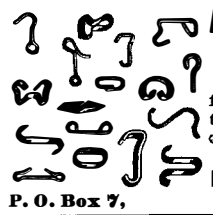
LATHES
FOR GUNSMITHS, TOOL MAKERS, EXPERIMENTAL AND REPAIR WORK, ETC.
Send for Illus. Catalog.
W. F. & Jno. Barnes Co.
1999 Ruby Street,
ROCKFORD, ILL.

THE BUFFALO GASOLENE MOTOR.

THIS cut shows our four cylinder, 4½ horse power, non-vibrating, shifting spark, varying speed from 100 to 1,500 revolutions, Gasolene Vehicle Motor, which we have demonstrated to be the most practical power in the market, occupying a space of 18 x 20 inches, manufactured upright or horizontal; weight 175 pounds. We build from one to eight horse power. For vehicles, boats and light stationary work, we can prove superiority.



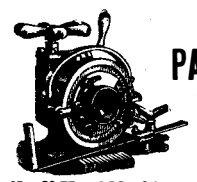
☞ *Send for Circular.*
BUFFALO GASOLENE MOTOR COMPANY,
Dewitt and Bradley Streets. Buffalo, N. Y.



Automatic Machines FOR FORMING WIRE
from coil into shapes similar to cuts. We can furnish machines or goods, as desired.
☞ *Send for Circulars.*
BLAKE & JOHNSON,
P. O. Box 7, WATERBURY, CONN.

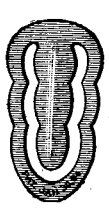
Patent Carrying Track
OVERHEAD TRAMWAY

for Mills, Foundries, Machine Shops, or for Merchandise. *Send for Book.*
The Coburn Trolley Track Mfg. Co.,
... HOLYOKE, MASS ...



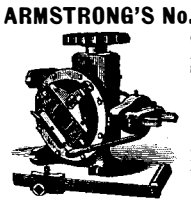
THE FORBES PATENT DIE STOCKS.
Two and three inch pipe can be threaded by a boy using only one hand on a crank.
☞ *Send for illustrated catalogue*
CURTIS & CURTIS,
No. 30 Hand Machine. Range ¼ to 2" R. & L. 6 Garden St., Bridgeport, Conn.

THE EUREKA CLIP
The most useful article ever invented for the purpose. Indispensable to Lawyers, Editors, Students, Bankers, Insurance Companies and business men generally. Book marker and paper clip. Does not mutilate the paper. Can be used repeatedly. In boxes of 100 for 25c. To be had of all booksellers, stationers and notion dealers, or by mail on receipt of price. Sample card, by mail, free. Manufactured by **Consolidated Safety Pin Co.,** Box 121, **Bloomfield, N. J.**



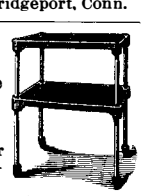
Size No. 2.

ARMSTRONG'S No. 0 THREADING MACHINE



Can be attached to bench or post. Designed for threading the smaller sizes of pipe, iron or brass, also bolts. Has two speeds, one for pipe ⅛ to 1 inch; the other for pipe 1¼ to 2 inches, inclusive. Uses the regular Armstrong adjustable dies. Other attractive features. Send for particulars. **The Armstrong Mfg. Co.,** 139 Centre Street, New York. Bridgeport, Conn.

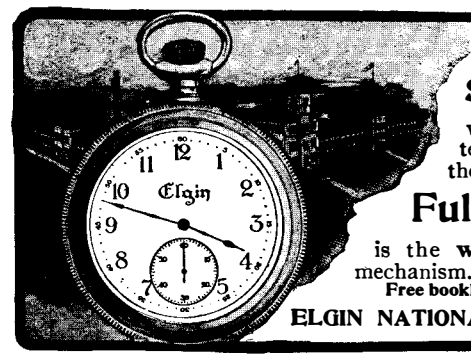
Don't Stoop
to little things. Keep them off the floor by using our
Portable Tool Racks.



A recognized shop necessity for work or tools. They combine convenience and economy.
New Britain Machine Co., New Britain, Conn., U. S. A.
Portable Pans for use under lathes too. Send for cuts.

Excavating machine, H. J. Bentson	646,674
Expansible bit, J. P. Lavigne	646,439
Fan motor, hot air, C. A. Anderson et al	646,406
Fare recorder, J. F. Ohmer	646,757
Fastener, F. C. Ingalls	646,738
Feed box, waste proof, F. Galloway	646,822
Feed water for boilers, purifying, C. Stickle	646,885
Fence, wire, N. D. Pope	646,648
Fencing, woven wire, J. Q. & A. C. Shimer	646,466
Fertilizers from refuse liquids, making, L. Rissmuller	646,559
Fertilizers, making, B. Terne	646,716
Fiber cleaning machine, F. Escalante	646,817
Fifth wheel, vehicle, W. H. Tuttle	646,587
File, document, H. T. Igelstrom	646,834
File or rasp cutting machine, J. A. Hess	646,698
Filter screen, I. H. Jewell	646,837
Fire escape, J. Cabus	646,635
Fire extinguisher, B. S. Brown	646,596
Fishing reel and reel rest, J. Howe	646,737
Floor and ceiling construction, T. O'Shea	646,504
Flue cutter, J. A. Barhydt	646,722
Flue cutter, B. Henrikson	646,907
Flue cutter, J. Mackenzie	646,747
Flushing apparatus, S. C. Houghton	646,832
Foot covering, protective, F. Konig	646,842
Fuel, artificial, H. M. Van Etten	646,650
Furnace for burning hydrocarbons, etc., J. A. & J. M. B. Rey	646,558
Furnaces, apparatus for supplying air, steam, or gaseous matter to, W. G. Stones	646,530
Furnaces, charging and drawing apparatus for heating, J. Swanger	646,475
Galvanic battery, medical, H. Bentz	646,793
Game apparatus, E. E. Bell	646,593
Game counter, J. M. Henry	646,524
Garment supporter, D. L. Mitchell	646,856
Garment supporter, J. A. Thomas	646,890
Gas by meters, device for preventing reregistration of, W. A. Haeberle	646,902
Gas generator, acetylene, H. J. A. & N. A. Giroux	646,731
Gas generator, acetylene, J. F. Guay	646,427
Gas machine, acetylene, J. McLean	646,452
Gas or vapor burner, F. V. Winters	646,483
Gas producer safety device, Randolph & Glasgow	646,608
Gas producers, punch bar device for, J. W. Gayner	646,687
Gate. See End gate. Lock gate.	
Gear, wheel driving, W. P. Freeman	646,730
Gearing, D. C. Frazeur	646,658
Gearing, M. T. B. Washington	646,652
Generator. See Gas generator. Steam generator.	
Gold and silver from their ores, extracting, T. Cruse	646,808
Gold dredge, drill, S. Babare	646,532
Governor, J. N. Rundle	646,505
Grain drill, double disk, C. P. Sester	646,506
Grain drill tube, J. W. Poindexter	646,872
Grain, fruit, etc., cleaning, scouring, and polishing machine for, J. S. Detwiler	646,550
Grate, W. McClave	646,913
Grate bar, reciprocating, J. A. Newton	646,584
Grease refining apparatus, garbage, B. Terne	646,715
Grinding cylinder, L. C. Bonnot	646,893
Hair curler, M. J. Maloof	646,543
Hame fastener, J. C. Hackett	646,733
Hammock and knapsack, combined, Donavin & Parsons	646,622
Hammock support, knockdown, P. Glor	646,732
Handle. See Alarm handle.	
Hanger. See Trousers hanger.	
Harrow, E. E. Whipple	646,774
Harrow, disk, J. O. Naistrom	646,453
Harvester, broom corn, J. S. Vaughn	646,612
Hat body forming machines, bat forming and feeding mechanism for, P. C. Waring	646,673
Hat fastener, Harper & Choate	646,735
Hat fastener, Kelly & Spruance	646,645
Hay rack, J. S. Campbell	646,409
Hay rake, H. Green	646,493
Headlight, H. J. Allen	646,615
Headlight, Barr & Kirby	646,617
Heater. See Electric heater. Tire heater.	
Heating system, W. B. Fox	646,901
Heel breasting machine, P. Hebert	646,829
Heel, shoe, P. Hebert	646,828
Hinge, friction, G. T. Wilson	646,613
Hoisting apparatus, pneumatic, H. A. Pedrick	646,458
Hook. See Singletree hook. Snap hook.	
Horse controlling device, C. W. Prince	646,607
Horseshoe, cushioned, J. M. Camp	646,534
Hose, electric signaling device for hydraulic, Stowe & Voorhees	646,886, 646,887
Hose or pipe coupling, W. D. Williams	646,590
Hydraulic elevator, H. J. Willard	646,776
Ice box attachment, A. B. Moyes	646,860
Indicator. See Elevator electrical indicator. Engine indicator. Office indicator.	
Ink well, D. H. Rowe	646,560
Ironing table, F. C. Kummerow	646,705
Isatin compounds, making aromatic, R. Knietsch et al	646,841
Key, F. B. Denman	646,621
Knitting machine, B. T. Steber	646,474
Knitting machinery, Schneebeli & Townsend	646,875
Knob and bell, combined door, G. W. Peterson	646,870
Ladder, scaling, J. A. Weston	646,513
Lamp, electric arc, P. H. F. Spies	646,883
Lathe rest, W. Lodge	646,499
Lens grinding machine, compound, A. Wagner	646,672
Light. See Vacuum tube light.	
Linoleum machine, C. H. Scott	646,878
Loading or unloading apparatus, wagon, I. L. Vansant	646,671
Lock gate, T. T. Stoddard	646,767
Locomotive train line air pipes, automatic device for opening, J. N. King	646,739
Loom, H. I. Harriman	646,903 to 646,905
Loom, J. Northrop	646,865, 646,866
Loom take up mechanism, H. Wyman	646,614
Loom warp stop motion, J. F. Dustin	646,729, 646,812
Lubricant, A. H. Smith	646,548
Lubricator, McDonald & Hawley	646,450
Lumber loading device, O. Enger	646,816
Magazines, etc., holder for, Bleakley & Jennings	646,654
Mail bag catcher and deliverer, Maguire & Glover	646,443
Mail catcher and crane, L. L. Matthews	646,855
Mains, electric bond for street, A. A. Knudson	646,742
Matrices, preparing wood, C. Sears	646,547
Measuring device, tailor's, J. Leciejewski	646,498
Measuring machine, cloth, W. B. Smith	646,472
Memorandum and indicating device, C. D. Weaver	646,933
Mercerizing apparatus, H. E. Aykroyd	646,787
Metal working apparatus, electric, C. L. Coffin	646,619
Milk can, G. W. Knapp	646,704
Milk separating apparatus, with siphon arrangement, E. Winkley	646,778
Mill. See Pulverizing mill.	
Miter box, J. W. Wilkinson	646,479
Mixer. See Concrete mixer. Paint mixer. Sand mixer.	
Mordanting, A. F. Poirrier	646,760
Mortising machine, L. W. & G. W. Greenleaf	646,576
Motor. See Fan motor. Rotary motor. Surf motor. Water motor.	
Motor, Thornton & Lea	646,770
Motor frame, S. H. Short	646,467
Mowing machine cutter, W. H. Ruef	646,562
Music or book leaf turner, Alter & Anchors	646,405
Musical sounding board, S. A. Hunt	646,539
Nails, machine for manufacturing wire, J. Wikstrem	646,478
Nest, hen's, W. R. Petty	646,871
Nut lock, J. G. Deaderick	646,895
Nut lock, H. A. Deiters	646,897, 646,898
Nut lock, J. C. Gentry	646,425
Office indicator, S. H. Peek	646,914
Oil can or tank, E. O. Linton	646,527
Operating table, G. E. Gorham	646,574
Ordnance, F. W. Brooks	646,595
Ores, etc., grinder for crushed, Wiswell & Smith	646,484
Organ, violin, N. E. Nelson	646,864
Packing box, hexagon, T. F. W. Schmidt	646,920
Packing case, E. Doering	646,536
Packing, piston rod, M. E. Briggs	646,797
Paint mixer, C. J. McLennan	646,555
Pants guard, G. S. Cole	646,488
Paper bag machine, A. L. Parrish	646,605
Paper box, E. N. Lorscheider	646,852
Paper box covering machine, M. F. Wilson	646,514, 646,515
Paper cutter, self clamping, C. L. Smith	646,880
Paper pulp from shavings, production of, J. Norton	646,557
Pea vine or clover cutter, J. C. McCollum	646,862
Photographic developing cabinet, P. H. Holmes	646,699
Photographic printing frame, W. Hull	646,664
Pianoforte frame, Greenwood & Bennett	646,577
Pick, miner's, J. B. Lucas	646,441
Pig extractor, White & Semple	646,632
Pipe clamp, leak closing, F. A. Nusbaum	646,754
Pipe wrench, E. Wright	646,565
Pipes or conduits, apparatus for scouring and cleaning, F. Novotony	646,545
Piping systems, apparatus for describing, E. A. McAllister	646,449
Planter, hand, W. C. Johnson	646,554
Pneumatic elevator, J. B. Schuman	646,877
Pot. See Coffee or tea pot.	
Potato digger and harvester, F. P. Jones	646,433
Press. See Bailing press.	
Printing machine, E. Lambert	646,437
Printing press feeder or pusher, A. F. Harris	646,827
Projectile, W. L. Breath	646,569

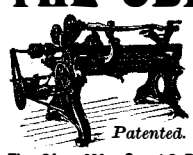
(*Continued on page 238*)



Behind the Elgin Watch Stands the Elgin Factory
with its guarantee. Every movement is tested, timed and proven before leaving the factory. The
Full Ruby Jeweled Elgin
is the **world's standard** of time-measuring mechanism.
Free booklet—"The Ways of a Watch" on request.
ELGIN NATIONAL WATCH CO., - - Elgin, Ill.

Queen Transits and Levels
High Grade Instruments with the Latest Improvements.
160 page Engineering Catalogue on application. THE QUEEN 240 page Mathematical Catalogue on application.
ENGINEERS' AND DRAFTSMEN'S SUPPLIES.
QUEEN & CO., Optical and Scientific Instrument Works,
59 Fifth Ave., New York. 1010 Chestnut St., Phila.

THE OBER LATHES



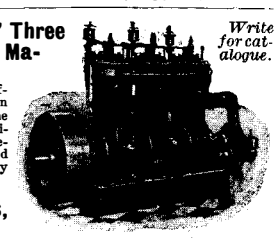
Patented.
For Turning Axe, Adze, Pick Sledge, Hatchet, Hammer, Auger, File, Knife and Chisel Handles, Whiffletrees, Yokes, Spokes, Porch Spindles, Stair Balusters, Table and Chair Legs and other irregular work.
☞ *Send for Circular A.*
The Ober Mfg. Co., 10 Bell St., Chagrin Falls, O., U.S.A.

WE EXCEL AND UNDERSELL ALL!

Electric Carriage Lights,	$4.35
$15 Telephones, complete,	5.95
Telegraph Outfits,	2.75
$8 Medical Batteries,	3.95
Battery Table Lamps,	3.00
Electric Railways,	2.95
Electric Necktie Lights,	.75
Miniature Electric Lamps,	.30

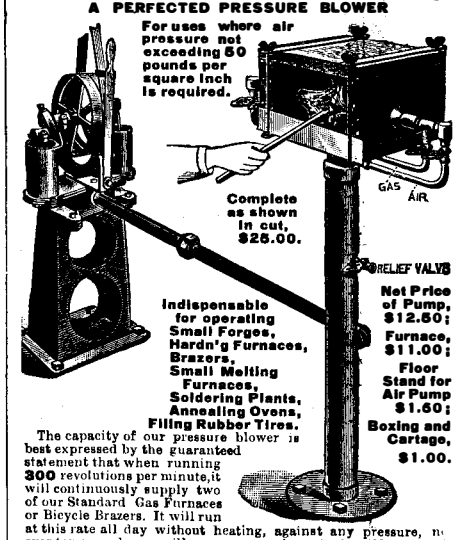
Agents Wanted. Send for New Catalogue, just out.
OHIO ELECTRIC WORKS, Cleveland, Ohio
Headquarters for Electric Novelties, Supplies, Books.

The "Wolverine" Three Cylinder Gasoline Marine Engine.
The only reversing and self-starting gasoline engine on the market. Lightest engine for the power built. Practically no vibration. Absolutely safe. Single, double and triple marine and stationary motors from ¾ to 30 H. P.
WOLVERINE MOTOR WORKS, Grand Rapids, Mich.



Write for catalogue.

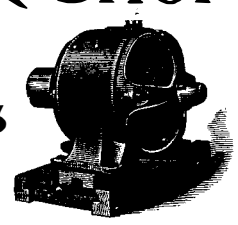
COMSTOCK'S Twin Cylinder Air Pump
A PERFECTED PRESSURE BLOWER


For uses where air pressure not exceeding 50 pounds per square inch is required.
Complete as shown in cut, $25.00.
GAS
AIR
RELIEF VALVE
Indispensable for operating Small Forges, Hardn'g Furnaces, Brazers, Small Melting Furnaces, Soldering Plants, Annealing Ovens, Filing Rubber Tires.
Net Price of Pump, $12.50;
Furnace, $11.00;
Floor Stand for Air Pump $1.50;
Boxing and Cartage, $1.00.

The capacity of our pressure blower is best expressed by the guaranteed statement that when running 300 revolutions per minute, it will continuously supply two of our Standard Gas Furnaces or Bicycle Brazers. It will run at this rate all day without heating, against any pressure, not over ten pounds, or will pump up a large tank to fifty pounds pressure. Has actual efficiency of 30 per cent. above that of any other known blower. Saves time, power, labor, wages.
STANDARD GAS FORGE AND BRAZER.
Essentially two Bunsen burners with flames meeting in center (latterally) of a muffle 10 in. wide, 7 in. high, 9 in. deep, inside measurements. Designed for shop and tool room use. Work done better, quicker, more cheaply than on bench forge. No chimney, smoke or smell. Work always in sight. Made of tile, any one replaceable. Send for free circular.
A. S. COMSTOCK, 71 W. Jackson Boulevard, Chicago.

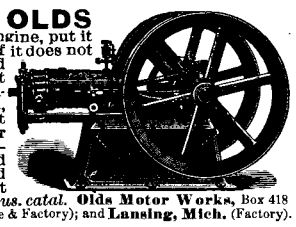
SUBMARINE TELEGRAPH.—A POPular article upon cable telegraphing. SCIENTIFIC AMERICAN SUPPLEMENT 1134. Price 10 cents. For sale by Munn & Co. and all newsdealers.

YOU CAN HAVE YOUR SHOP
on the main street as well as in a back alley by using
GE SMALL MOTORS
which cost nothing when not working.
Write for information to



GENERAL ELECTRIC CO., Main Office, SCHENECTADY, N. Y.

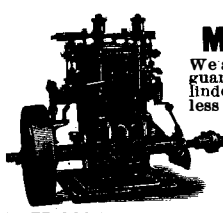
TAKE AN OLDS
Gas or Gasoline Engine, put it on your work and if it does not fulfill our claims and satisfy you that there is no better engine on the market, send it back without expense to you. Our electric & tube igniters are unsurpassed. Our self contained engines are most convenient. *Free illus. catal.* Olds Motor Works, Box 418 Detroit, Mich. (Office & Factory); and Lansing, Mich. (Factory).



IF INTERESTED WRITE TO-DAY

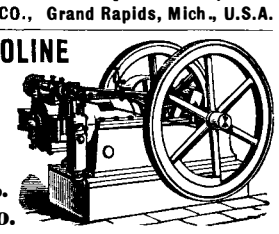
President Eliot, of Harvard University, while addressing the graduating class, in part said:
"There is a subtle power lying latent in each one of you, which few have developed, but which, when developed, might make a man irresistible. It is called personal magnetism. I advise you to master it."
That the power referred to above lies latent in every person, and can be easily and quickly developed, are facts acknowledged by every student of the subject.
Hardly a day passes but what one reads of some astounding feat or wonderful cure performed by persons of well-developed magnetic power.
The New York Institute of Science has recently issued probably the most interesting, most valuable, and most important work on occult sciences ever before published. It is up-to-date in every particular. Its 100 pages are replete with facts, arguments and opinions of the world's greatest scientists and teachers. It is profusely illustrated, and should be read by every person at all interested in Mesmerism, Personal Magnetism and Mind Cultivation.
IT'S FREE
for the asking. Write to-day. Address
New York Institute of Science
39 STATE ST., Dept. M.R.11, ROCHESTER, N.Y.

THE IMPROVED MARINE ENGINE



We are the oldest builders and guarantee superiority. Two cylinders in one casting. Occupies less space and weighs less for its power than any engine made. Can be used wherever power is required. Either stationary or marine. No fire, no heat, no smoke. No licensed engineer required. *Send for cat.*
SINTZ GAS ENGINE CO., Grand Rapids, Mich., U.S.A.

GAS and GASOLINE ENGINES.
Using Natural Gas, Coal Gas, Producer Gas, and Gasoline direct from the tank. 1 to 40 H. P., *actual.*
The Springfield Gas Engine Co.
21 W. Washington St.
Springfield, O.



ACETYLENE GAS AND CARBIDE OF Calcium.—All about the new illuminant, its qualities, chemistry, pressure of liquefaction, its probable future, experiments performed with it. A most valuable series of articles, giving in complete form the particulars of this subject. Details of furnaces for making the carbide, gas generators, gasometers, burners, etc. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, Nos. 998, 1004, 1007, 1012, 1014, 1015, 1016, 1022, 1035, 1038, 1057, 1064, 1071, 1072, 1082, 1083, 1084, 1085, 1086, 1104, 1124, 1132, 1149 and 1150. Price 10 cents each, by mail, from this office, and all newsdealers.

THE LOZIER GAS ENGINE

Reliable as a Steam Engine.
Perfect { LUBRICATION—Automatic Oiler sprays Piston every stroke.
COMBUSTION—The same rain or shine.
MIXING—Of gasoline and air.
CONSTRUCTION—Finest ever produced.

"CLUB SPECIAL" is the name of our popular launch for fishing, hunting and general club use. Length 31 ft., 6 in.—perfectly safe and seaworthy. Write us for free advance catalogue of safe engines and good boats. Marine Dept.
LOZIER MOTOR CO. 26 Gardner Blk. TOLEDO, OHIO.

ELECTRICAL ENGINEERING taught by mail. Instruction at home; adapted to everyone. Electrical or Mechanical Engineering; Mechanical Drawing. Guidance of experienced, able instructors. Takes spare time only. Thos. A. Edison and others endorse Institute. Catalogue free. ELECTRICAL ENGINEER INSTITUTE, Dept. A, 240-242 West 23d St., New York.

If You Want the Best Lathe and Drill CHUCKS

BUY WESTCOTT'S *Strongest Grip, Greatest Capacity and Durability, Cheap and Accurate.*

Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.
FIRST PRIZE AT COLUMBIAN EXPOSITION, 1893.

SOMETHING NEW! SOMETHING NEW!!

Pat'd Feb. 2, 1897.

The U. S. "AUTOMATIC" HAND FIRE EXTINGUISHER.

We challenge the world to produce our equal. Hang it up, it is **sealed.** Take it down, it is **unsealed.**

Safe, Sure, Simple, Quick.

Cannot get out of order. Needs no attention. Most Efficient, Durable, and Economical Fire Extinguisher in the world. You can load and shoot it at will. Chemicals same as all Fire Departments use, and can be had at any drug store for 10 cents. Once loaded, it will last for years, and is ready for instant use day or night. ☞ *Agents Wanted Everywhere.*

The U. S. Fire Extinguisher Mfg. Co.,
SOLE MANUFACTURERS,
260 West 23d St., New York, U. S. A.
NOTE—*The offices of "Scientific American" are equipped with "U. S."*

Cork Floors and Tiles.

Elegant in appearance, absolutely noiseless, germproof and waterproof, and have unequaled wearing qualities. We also manufacture

CORK PULLEY COVERING,
CORK PIPE COVERING,
CORK FRICTION CLUTCH BLOCKS,
CORK BULLETIN BOARDS, etc.
☞ *Send for Circular "S. A."*
CORK FLOOR & TILE CO., South Framingham, Mass.

A New Button
THE BEST THING YET!

Is simple and durable, and can be put on and taken off at will. Nothing like it in the world. Try a set and be convinced. If your dealer does not keep them send 25c. to us for sample doz.

THE L. & H. SUPPLY CO.,
85 Commercial Avenue, Binghamton, N. Y.

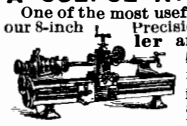
THE HOMEMADE WINDMILLS OF NEBRASKA.
A most valuable series of articles condensed from the official Bulletin by Erwin Hinckley Barbour, is published in Supplements Nos. **1254, 1255** and **1256.** The series is accompanied by thirty-three illustrations and gives a detailed description of a number of types of windmills which can be made by anyone who has any mechanical skill. These windmills are being made and used in large numbers in Nebraska and are giving great satisfaction. These Supplements for sale by all newsdealers, 10 cents each, or by MUNN & Co., 361 Broadway, New York City.

PLUMBERS' LEVEL.

An adjustable incline Level, a fixed Level, and a Plumb. Shows incline by 32ds, or less, to 2 in. to the foot. A longitudinal groove in seat of frame adapts it to rest on pipe or shaft. Price 15 in., with plain glass, $3.00; with ground glass, $6.00. ☞ *Catalogue of Fine Tools free.* **THE L. S. STARRETT CO.,** Box 13, Athol, Mass., U. S. A.

A USEFUL ATTACHMENT

One of the most useful appliances in connection with our 8-inch Precision Lathe is the **Traverse Miller** and **Grinder** which mills and grinds work the entire length of lathe. It is invaluable for such work as fluting, channeling, grooving, keyway cutting, etc. Easy of adjustment to any angle. The finest and most accurate of work can be done with this attachment—none better possible. For fluting taps, reamers, broaches, counter bores, etc., it is unrivaled.



FANEUIL WATCH TOOL CO., Brighton, Boston, Mass.

The New YANKEE DRILL GRINDER
Scientifically Correct.

IRON-WORKERS. More of these machines have gone into the leading plants of the world in the last two or three years than any other. **WHY?** Because hand ground drills **wont** do correct work. They break, wear tapering, and only last half as long as machine ground. Send for catalogue explaining all of these things. This is the only drill grinder ever made requiring but one preliminary adjustment. Write to us **Now** for full data. **THE FULLER MFG. CO.,** Successors to G. T. Eames Co., **250 Asylum Av., Kalamazoo, Mich., U.S.A.**

ENAMEL!

High-grade Enameling done on Sheet Iron, Steel and Cast-Iron.
Enameled Signs for Advertising Purposes in All Colors.
Street Names and Numbers a Specialty.
Acid-proof Enamel for Chemical and Pharmaceutical Apparatus.
Majolica Enamel for Ornamental Cast-Iron Work (New).
Special Enamel for Electrical Heating Apparatus.
BALTIMORE ENAMEL CO., No. 2,
Foot Allen Street, Baltimore, Md., U. S. A.

A BIG INCOME
Can be made **GIVING PUBLIC ENTERTAINMENTS** in Churches, Halls, and Theatres **with MOTION PICTURES the new Grapho-Amplifone, MUSICAL and Talking Combination** and **Panoramic Stereopticon Views. $60 to $300 PER WEEK.** Pleasant employment and **any man** can operate them. **COMPLETE OUTFITS,** including **large illustrated Advertising Bills (18x24),** admission tickets, instruction book, business guide, etc., **$39.50 and up.** Most interesting and sensational subjects, just out. Will be sent **C.O.D.** subject to examination. Write for catalogue and **copies of letters** from exhibitors who are **MAKING BIG MONEY with our outfits.**
ENTERTAINMENT SUPPLY CO. Dept. AA, 56-58 5th Ave. CHICAGO

Your Name in Gold
on a handsome combination **Genuine Leather Card Case** and **Pocketbook,** and
100 CARDS
imitation **ENGRAVED,** mailed, postpaid, on receipt of **50 CENTS** in stamps.
☞ **Agents Wanted.**

R. A. CHAPMAN, 44 Stanton Street, New York.

Propeller shaft clutch, A. A. Low	646,745
Pull or handle, J. H. Gavin	646,823
Puller. See Tack puller.	
Pulley, T. Corscaden	646,414
Pulverizer and harrow, combined, L. G. Krueger	646,646
Pulverizing mill, T. J. Sturtevant	646,507
Pump, air lift, G. H. Evans	646,640
Pump, force and suction, E. Noppel	646,668
Pump, lift and force, E. Noppel	646,455
Pump, steam vacuum, J. W. Eberman	646,899
Pump tube, F. T. Brosi	646,634
Puzzle, F. A. Schossow	646,463
Rack. See Display rack. Hay rack.	
Radial drill, A. Mill	646,750
Radiator and heater therefor, F. V. Winters	646,482
Rail and frog brace, combined guard, J. E. Graham	646,825
Railway automatic switch, street, R. M. Stewart	646,766
Railway signal, H. B. Taylor	646,714
Railway signal, Wayland & Taylor	646,717 to 646,719
Railway system, surface contact, Paul & Wriggers	646,626
Railways, automatic safety appliance for, G. S. Jeffreys	646,836
Rake. See Hay rake.	
Recorder. See Fare recorder.	
Reel. See Fishing reel.	
Refrigerator car ventilator, A. Richmond	646,628
Refrigerator crate, W. A. Schrei (reissue)	11,815
Refrigerator drain pipe trap, J. I. Payne	646,606
Register. See Cash register.	
Regulator. See Temperature regulator.	
Regulator, R. M. Dixon	646,417
Relay, L. Cerebotani	646,598
Retort charging apparatus, W. Foulis	646,820
Reversing and cut out switch, T. von Zweigbergk	646,485
Rock crusher, J. R. Brown	646,516
Roll housing and bearing, W. G. Whiteley	646,934
Roof, S. R. Hawthorne	646,623
Roofing, F. Jager	646,494, 646,495
Rotary engine, J. P. Doran	646,419, 646,420
Rotary motor, J. Keller	646,702
Roving machine, M. Campbell	646,410
Saddle horn, riding, F. H. Nierman	646,753
Salt and pepper holder, F. M. Lepore	646,846
Salt making apparatus, A. Wilderspin	646,775
Sand blast for surfacing metal, glass, etc., W. H. King	646,740
Sand mixer, J. W. Du Bois	646,686
Sash fastener, J. A. Johnson	646,909
Saw and engine therefor, drag, A. S. Hill	646,662
Saw attachment, hand, J. W. Wilkinson	646,490
Scale, price, J. H. Schneider	646,586
Seal, E. J. Brooks	646,798
Seat covering, outdoor, P. W. Bramwell	646,655
Sewage into tidal waters, device for regulating discharge of, D. Cameron et al	646,927
Sewage into tidal waters, self acting valve for, regulating discharge of, D. Cameron et al	646,929
Sewage treating apparatus, D. Cameron et al	646,928
Sewing machine, A. Tetrault	646,932
Sewing machine, buttonhole, W. N. Parkes	646,758
Sewing machine, hat, E. G. O'Donnell	646,756
Sewing machine, shoe, J. E. Bertrand	646,594
Shaft, sulky, E. S. Frazier	646,642
Shafts, etc., shouldered coupling for, M. C. Bullock	646,597
Shears attachment, P. S. Wiseman	646,633
Shelf, folding bracket, W. A. Petrie	646,759
Ships from sinking, means for preventing, F. G. Broughton	646,800
Show window plates, fastening for, P. P. Hasek	646,601
Signal. See Railway signal.	
Singletree hook, C. C. Shults	646,879
Skimmer, combined gang, P. M. Bawtinhimer	646,486
Sled propeller, J. B. Pastor	646,868
Snap hook, J. C. Covert	646,519
Spraying apparatus, G. A. & R. F. Dunn	646,523
Spring. See Bed spring.	
Spring clamp for bills or accounts, A. W. Thierkoff	646,510
Square, framing, J. A. Van Namee	646,588
Steam boiler, Foure & Thuile	646,821
Steam engine, A. S. Hill	646,663
Steam generator, W. L. Crouch	646,727
Steam generator, J. & A. Niclausse	646,556
Steam trap, J. E. Swendeman	646,670
Steamers or steamships, ventilating or lighting arrangement for A. Angstrom	646,591
Steel, hardening, Meissner & Bennewitz	646,528
Stereotype finishing machine, W. Scott	646,669
Sterilizer for razors, etc., Winchel & Audas	646,481
Stoker, mechanical, G. H. Barrus	646,408
Stopper. See Boiler tube stopper. Bottle stopper.	
Storage battery, G. W. Gesner	646,552
Storage battery, E. A. Sperry	646,922
Stove, W. H. Loy	646,853
Stove, gas, J. A. Dailey	646,684
Stove, heating, McNaughton & Scott	646,863
Stove or range water back, W. J. Wood	646,779
Stoves, etc., combined heater and boiler for, D. Cline	646,411
Stovepipe coupling, A. A. Armitage	646,786
Stovepipe fastener, D. W. Smith	646,881
Strainer, L. Schutte	646,464
Strainer, milk, E. S. Lagerquist	646,434
Strainer, milk pail, M. S. Field	646,537
Strap holder, J. V. Washburne	646,661
Street sweeper, H. W. Libbey	646,624
Sulfonates, making, A. Verley	646,772
Surf motor, S. H. Emmens	646,816
Swing, convertible, W. Bultmann	646,802
Switch. See Branch or lamp switch. Reversing and cut out switch.	
Switch, D. Kerekes	646,496
Table. See Adjustable table. Ironing table. Operating table. Tilting table.	
Table adjuster, W. H. Wyatt	646,781
Tack puller, J. H. Driller	646,811
Tag, shipping, J. M. Crocker	646,807
Teaching the elements of geography, apparatus for, V. T. Murche	646,582
Teeth, device for regulating, W. P. Sugatt	646,639
Telephone exchange system, E. E. Clement 646,675, 646,677, 646,679, 646,681 to	646,683
Telephone exchange system, Clement & Gharky	646,680
Telephone exchange system, W. D. Gharky 646,692, 646,696,	646,697
Telephone exchange system, Gharky & Clement 646,694,	646,695
Telephone switchboards, plug seat for, A. K. Keller	646,701
Telephone system, W. D. Gharky	646,689
Telephone system and apparatus, intercommunicating, W. D. Gharky	646,690
Telephone transmitter, E. E. Clement	646,678
Telephones, instrument for measured service, C. Gierding	646,643
Temperature regulator, T. O. Perry	646,915
Tent and cape, combined shelter, L. Fisher	646,421
Thill coupling, C. C. Bradley	646,568
Thill coupling, A. McAvoy	646,666
Thill coupling, A. Schubert	646,649
Thill coupling, A. H. Worrest	646,531
Thresher stacker fan, W. N. Rumly	646,708
Threshing machine, B. Jackle	646,540
Threshold, G. A. Seely	646,485
Tile, H. F. Webb	646,589
Tilting table, A. J. Jameson	646,665
Tire, bicycle, M. E. Stacy	646,473
Tire heater, E. Beeson	646,567
Tire, pneumatic, F. A. Sieberling	646,709, 646,710
Tire repairing apparatus, pneumatic, F. A. Sieberling	646,610
Tires or other rubber articles, mold for making cushion, J. A. Collet	646,413
Tombstones, etc., setting, J. O'Connell	646,755
Tools, machine for actuating reciprocating, J. W. Stow	646,924
Tooth, artificial, H. R. Nebrbass	646,603
Tooth, artificial, T. Steele	646,764
Toy ball, D. K. Alden	646,785
Toy, detonating, Graber & Paulus	646,575
Trap. See Steam trap.	
Trestle, knockdown, B. E. Cronkhite	646,620
Trolley, W. B. Potter	646,460
Trousers hanger, elastic, W. B. Tyler	646,771
Truck, car, S. W. McMunn	646,583
Truss, I. E. Johnson	646,579
Truss, hernial, A. Bedson	646,723
Tube. See Pump tube.	
Type tray, J. Grant	646,426
Umbrella, folding, D. Carpenter	646,725
Vacuum tube light, D. M. Moore	646,858
Valve and pump, automatic steam, T. R. Browne	646,926
Valve for fluid pressure brake systems, engineer's, N. A. Christensen	646,618
Valve gear, cut off, R. Hardie	646,429
Valve, pressure reducing, R. Hardie	646,428
Valve, reversing, J. Keller	646,703
Valve wheel, J. P. Lewis	646,912
Vehicle, A. Smithson et al	646,563
Vehicle brake, J. Ferrel	646,641
Vehicle driving mechanism, E. Childs	646,803
Vehicle wheel, J. Bell	646,790
Vehicle wheel, R. Mulholland	646,751
Vending machine, W. M. Mack	646,746
Ventilator. See Refrigerator car ventilator.	
Vessel, W. B. Motheral	646,859
Wagon box, E. W. Fonda	646,492
Wagon brake, J. F. Hart	646,906
Wagon running gear, J. Mock, Sr	646,857
Wardrobe, F. Vogel	640,512
Washer. See Bottle washer.	
Washing machine, R. Murphy	646,861

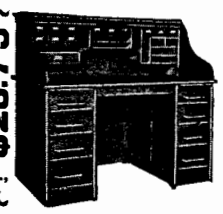
(Continued on page 239)

DICKERMAN'S DURABLE DESKS ARE GUARANTEED.

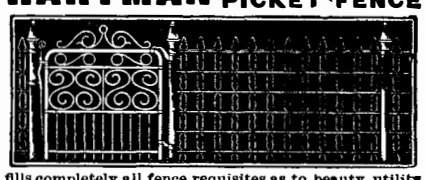
This desk in carefully selected oak with magnificent golden polish finish. Case work, drawers and pigeon holes all of solid wood with quarter sawed oak fronts. Has letter file, stationery compartment, partitions for books, extension slide, partitioned drawers. Size 48 in. long, **$23.75**; 54 in., **$25.75**; 60 in., **$27.75.** Depth of desks 30 in.; height 49 in. **Guaranteed** and shipped on approval, **freight prepaid** east of the Mississippi with reduction beyond. Send for free illustrated catalog No. 36 of exceptional desk values. Address either

AMERICAN DESK COMPANY, 18-20 E. Van Buren St., Chicago.
AMERICAN STORE STOOL CO., Howard & Crosby Sts., New York.

$23.75



HARTMAN STEEL ROD PICKET FENCE



fills completely all fence requisites as to beauty, utility and durability. Specially designed for lawns, parks, cemeteries, school grounds, &c. Looks best and is best when built with our steel posts. Illustrated catalog free.
HARTMAN M'F'G CO., BOX 69 ELLWOOD CITY, PA.
or Room 99, 309 Broadway, New York City.

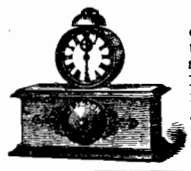
WELL DRILLING Machines

Over 70 sizes and styles, for drilling either deep or shallow wells in any kind of soil or rock. Mounted on wheels or on sills. With engines or horse powers. Strong, simple and durable. Any mechanic can operate them easily. Send for catalog.
WILLIAMS BROS., Ithaca, N. Y.

THE NEW BRISTOL COUNTER

Registers an accurate account of work done on printing presses, grain tallies, weighing, measuring and other automatic machines. Counts up to 1,000 000 and repeats automatically. Simple, accurate, durable. Special counters to order. ☞ *Send for circular.*
C. J. ROOT, Bristol, Conn., U. S. A.

Perfection Electric Alarm Clock.



A great improvement over the ordinary alarm clock. Rings until you get up and stop it. 3-inch silver-toned bell. Battery lasts 12 to 18 months. Highly ornamental and effective. ☞ *Send for Circular and Price List S. A.*
THE J. JONES & SON CO.
64 Cortlandt Street, New York.

Keep Your Horse Healthy
See that his stable is fitted with
LOGAN'S PATENT STALL DRAIN
which carries off all filth and bad odors. Saves its cost in one year. Prolongs the animal's life and adds to its usefulness. ☞ *Booklet Free.*
Logan Sanitary Horse Stall Company, 1682 Broadway, New York.

DO YOU USE GRINDSTONES?

If so we can supply you. All sizes **mounted** and **unmounted,** always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

SIDE PLEATING MACHINE

that can be set to any desired length and **size** of pleat, and
PLEATS ALL KINDS OF GOODS.
We manufacture also **pinking** and **fluting machines** and all kinds of Ladies' dress making **machinery.**
NEW CHAMPION PRESS CO.,
173 Grand St., New York.
Makers of **Hand Printing Presses** and special machinery of any kind.

Chemical Laboratory Wanted

We wish to enlarge our chemical laboratory. Dealers—or others—having such supplies to offer should write
JAMES E. PATTON CO., MILWAUKEE, WIS.

Magic Lanterns, Slides, Films, and Moving Picture Machines. Write for our Bargain List No. 1.
WILLIAMS, BROWN & EARLE, Philadelphia, Pa.

REVERSING STEAM TURBINE.—PARSON'S recently perfected turbine for boats. Illustrations showing details. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1158.** Price 10 cents, by mail, from this office, and from all newsdealers.

ILLUSTRATING TAUGHT BY MAIL.

Newspaper Sketching, Washdrawing, Pastel and higher Illustration. Adapted to all. Personal instruction and criticism same as in our resident school. Prepares quickly for profitable work. Moderate rates. Write for particulars.
NATIONAL SCHOOL OF ILLUSTRATING, 38 Penn. St., Indianapolis, Ind.

SOMETHING NEW
ELEGANT AND DRESSY.
THE "CHID" CRACKLESS LINEN CUFF
If your dealer does not have them, send 25c. for a pair.
THE CHID CUFF CO.
908 D Lippincott Building, Philadelphia, Pa.

PRINT YOUR OWN CARDS, etc.
$5 PRESS Circular or Small Newspaper Press **$18.** Typesetting easy. Money maker or saver. Send stamp for catalogue, presses, type, paper, etc. **THE PRESS CO., Meriden, Conn.**

CUFFS HELD...

with the **Improved Washburne Patent Cuff Holders** can be placed just where you want them; will never slip but may be instantly released. Drawers Supporters, easily adjusted or taken off—excellent for holding golf trousers. By mail, 20c. the pair. ☞ *Catalogue showing these and other novelties, free.*

American Ring Co., Box P. Waterbury, Conn.

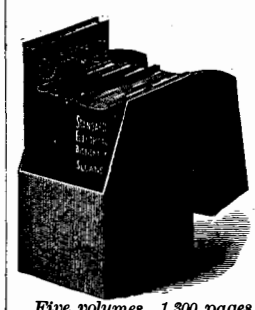
CROOKES TUBES AND ROENTGEN'S
Photography.—The new photography as performed by the use of Crookes tubes as a source of excitation. All about Crookes tubes. SCIENTIFIC AMERICAN SUPPLEMENT, Nos. **181, 189, 238, 243, 244, 792, 795, 905, 908, 1050, 1054, 1055, 1056, 1057,** also SCIENTIFIC AMERICAN, Nos. **7, 8, 10** and **14,** Vol. 74. These profusely illustrated SUPPLEMENTS contain a most exhaustive series of articles on Crookes tubes and the experiments performed with them. Among them will be found Prof. Crookes' early lectures, detailing very fully the experiments which so excited the world, and which are now again exciting attention in connection with Roentgen's photography. Price 10 cents each. To be had at this office and from all newsdealers.

Costs about 12 cents a year to maintain **The Matchless**
Electric Cigar Lighter

Invaluable for hotels, private dwellings, factories, etc., etc. If not on sale by your dealer write us for catalogue and price list.
STANLEY & PATTERSON,
Gen'l Elec. Equipment Supplies,
30-32 Frankfort St., NEW YORK.

A COMPLETE Electrical Library

By PROF. T. O'CONOR SLOANE.



An inexpensive library of the best books on Electricity. Put up in a neat folding box, as shown in cut. For the student, the amateur, the workshop, the electrical engineer, schools and colleges. Comprising five books, as follows:

Arithmetic of Electricity 138 pages, . . . $1.00
Electric Toy Making, 140 pages, ... $1.00
How to Become a Successful Electrician, 189 pages, ... $1.00
Standard Electrical Dictionary, 682 pages. $3.00
Electricity Simplified, 158 pages, ... $1.00

Five volumes, 1,300 pages, and over 450 illustrations.
A valuable and indispensable addition to every library.

Our Great Special Offer.—We will send prepaid the above five volumes, handsomely bound in blue cloth, with silver lettering, and inclosed in a neat folding box, as shown in the illustration, at the **Special Reduced Price of $5.00** for the complete set. The regular price of the five volumes is $7.00.

MUNN & CO., Publishers,
361 BROADWAY, NEW YORK.

$1000 IN GOLD FREE

FOR BRAINY PEOPLE

14	5	23	25	15	18	11				
23	1	19	8	9	14	7	20	15	14	
3	8	9	3	1	7	15				

FOR BRAINY PEOPLE

Each one of the above three lines of figures spells the name of a great city in the United States. This is a brand new puzzle and can be solved with a little study, as follows: There are twenty-six letters in the alphabet, and we have used figures in spelling the cities instead of letters. Letter A is number 1, B number 2, C number 3, etc., throughout the entire alphabet. **IF YOU CAN SPELL OUT THESE THREE CITIES YOU MAY SHARE IN THE DISTRIBUTION OF $1,000 WHICH WE ARE GIVING AWAY** for doing a little work for us. This you can do in less than one hour of your time. This and other most liberal offers are made to introduce one of the very best New York magazines into every home in the United States and Canada. **WE DO NOT WANT ONE CENT OF YOUR MONEY.** When you have made out the names of these three cities, write them plainly on a postal card and send it to us, and you will hear from us promptly **BY RETURN MAIL.** It may take an entire evening to solve the three names, but **STICK TO IT AND TRY TO GET YOUR SHARE OF THE $1,000.** A copy of this high-class **ONE DOLLAR MAGAZINE WILL BE SENT FREE** to everyone answering this advertisement. Do not delay. Send your answer in immediately. Address **ROBINSON PUBLISHING CO., 24 North William Street, New York City.**

Don't Waste the Summer.

Study **Journalism.** We fit you for practical newspaper work, for short story writing, and magazine literature, or improve your literary talent.

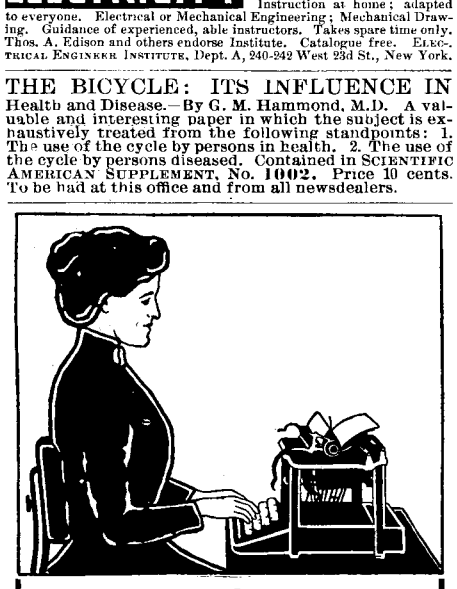
Study **Engineering.** We prepare you for railroad, steam, structural engineering, etc. Architectural and mechanical drafting, etc. Graduation with degrees.

Complete Schools also of **Science, Book-keeping** and **Shorthand.** Write for announcement of school in which you are interested.

NATIONAL CORRESPONDENCE INSTITUTE,
28-60 2d Nat'l Bank Building, Washington, D. C.

ELECTRICITY TAUGHT BY MAIL Instruction at home; adapted to everyone. Electrical or Mechanical Engineering; Mechanical Drawing. Guidance of experienced, able instructors. Takes spare time only. Thos. A. Edison and others endorse Institute. Catalogue free. ELECTRICAL ENGINEER INSTITUTE, Dept. A, 240-242 West 23d St., New York.

THE BICYCLE: ITS INFLUENCE IN Health and Disease.—By G. M. Hammond, M.D. A valuable and interesting paper in which the subject is exhaustively treated from the following standpoints: 1. The use of the cycle by persons in health. 2. The use of the cycle by persons diseased. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **1002.** Price 10 cents. To be had at this office and from all newsdealers.

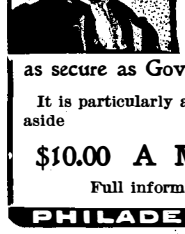


Remington
Typewriters
DO THE WORK
WYCKOFF, SEAMANS & BENEDICT,
327 Broadway, New York.

THE whole history of the world is written and pictured week by week in Collier's Weekly. So well written and so well pictured that it is now the leading illustrated record of current events and has the largest circulation of any periodical in the world that sells for three dollars or more per year.

On sale at all newsstands. Price 10 cents per copy. Sample copy free. Address COLLIER'S WEEKLY, 525 West 13th Street, New York City.

PENN MUTUAL LIFE INSURANCE CO.



Investors
find our "Bond Policy" more profitable and just as secure as Government Bonds.

It is particularly adapted to those who can lay aside

$10.00 A MONTH or more.

Full information by mail FREE.

PHILADELPHIA, PENN.

Mechanical Movements,
Powers, Devices, and Appliances.

By GARDNER D. HISCOX, M E., Author of "Gas, Gasoline, and Oil Engines."

A Dictionary of Mechanical Movements, Powers, Devices, and Appliances, embracing an illustrated description of the greatest variety of mechanical movements and devices in any language. A new work on illustrated mechanics, mechanical movements, devices and appliances, covering nearly the whole range of the practical and inventive field, for the use of Machinists, Mechanics, Inventors, Engineers, Draughtsmen, Students, and all others interested in any way in the devising and operation of mechanical works of any kind.

Large 8vo. 490 Pages. 1,649 Illustrations. Price **$3.**

☞ *A full table of contents will be sent free upon application to*

MUNN & CO., Publishers,
361 Broadway, New York.

Washing machine or churn, J. T. Crow 646,637
Watch dial, E. Krahenbuhl 646,843
Water motor, J. E. Symons 646,712
Water purifier, P. Schreck 646,876
Water purifying apparatus, J. B. Greer 646,931
Water purifying apparatus, J. MacDougall 646,854
Water resisting products from casein, manufacturing, Krische & Spitteler 646,844
Water supply and heating apparatus, A. G. Mather 646,445
Water wheel, J. E. Symons 646,713
Watering apparatus, stock, H. F. Barber 645,407
Weighing machines, cost indicating, registering, and weight totaling apparatus for, W. H. & W. L. D. Gundry 646,578
Well tool, oil, C. R. Fisk 646,422
Welt, W. B. Arnold 646,592
Wharf construction, H. C. Holmes 646,553
Wheel. See Bicycle wheel. Fifth wheel. Vehicle wheel. Valve wheel. Water wheel.
Whiffletree attachment, E. F. Bauerle 646,789
Wire connector, A. Gartner 646,573
Wire stretcher, J. C. Baker 646,925
Wire tightener, J. S. Hansford 646,826
Wires, connecting, Lamb & Hoxie 646,497
Wires, die for joining intersecting, Lamb & Hoxie 646,435
Wires, means for connecting, Lamb & Hoxie 646,436
Wood bending machine, A. B. Keyes 646,910
Wood drying apparatus, A. Lambiotte 646,706
Wrench. See Pipe wrench.
Wristband and cuff holder, combined, W. H. McDonald 646,667
Yeast and making same, A. J. Priest 646,761

DESIGNS.

Battery body, Seeger & Clarke 32,450
Bib, C. W. Kayser 32,461
Bookcase tops, end piece for, I. E. Rockwell 32,453
Bottle, water, W. B. Fenn ..... 32,426 to 32,428
Brush body, J. L. G. Dykes 32,435
Button head, collar, E. H. Wheeler 32,440
Button holder, G. C. Rueckert 32,430
Chimney cap member, J. Cooper 32,452
Confectionery tray, F. L. Daggett 32,429
Cup, C. J. Ahrenfeldt 32,421
Dish, covered, C. J. Ahrenfeldt 32,422, 32,423
Draft lug, L. A. Hoerr 32,449
Fan chamber and straw receiver, O. A. Nickelson 32,447
Fastener sleeve, expansion, E. J. McCormick 32,445
Flail stick ferrule, S. R. Divine 32,444
Flask or bottle, B. Bernheim 32,425
Furniture, etc., stock beading for trimming, E. A. Gay 32,439
Hoe, J. Bedford 32,448
Hook, wardrobe, F. A. Thomas 32,437
Ice creeper, M. Luther 32,441
Insect trap, G. C. Lewis 32,432
Jug, C. J. Ahrenfeldt 32,424
Lamp bracket, W. P. Crary 32,430
Musical instrument casing, G. A. Brachhausen 32,433, 32,434
Nut for expansion fasteners, E. J. McCormick 32,446
Pail handle, W. H. Zimmerman 32,443
Pump stand, W. K. Peters 32,454
Saddle fork, side, M. Marks 32,442
Sewer trap body, P. J. Madden 32,451
Spoon holder, W. H. Loonie 32,420
Stove, W. H. Landers 32,455
Thread package, F. E. Warburton 32,431
Toy, E. Brown 32,460
Washboard, W. E. Kirschhoff 32,456
Wheel, traction, G. F. Conner ..... 32,457 to 32,459
Whip load, Pomeroy & Van Deusen 32,438

TRADE MARKS.

Appliances for body wear, curative toilet brushes, and massage implements and appliances, A. T. Sandeh 34,425
Canned foods, cured meats, and lard, certain named, German American Provision Company 34,410
Cards, playing, A. Gabarro y Castello 34,396, 34,397
Chemical, pharmaceutical, surgical, dietetic, and cosmetic products and preparations, certain named, Ichthyol-Gesellschaft, Cordes, Hermanni & Company 34,426, 34,427
Cigarettes and cigarette tobacco, John Bollman Company 34,407
Cigars, Ames-Pearson Tobacco Company 34,408
Cutlery and tools, certain named, K. Tornblom 34,433
Dairy products, certain named, Anglo-Swiss Condensed Milk Company 34,413
Flour, W. A. Brady 34,412
Food or as ingredients in foods, such as meat extract, etc., substances used as, Liebig's Extract of Meat Company 34,414
Food products, certain named prepared, J. Smith 34,409
Fur skins, dyed, H. F. Bindseil 34,405
Hostlery supplies, certain named, Murray & Company 34,431
Iron, steel, and manufactures, certain named American Tin Plate Company ..... 34,436 to 34,440
Leads, certain named, Davis Lead Company of Pittsburg 34,430
Matches, American Match Machine Company ..... 34,404 to 34,406
Medical compounds and soap, certain named, Ferdon & Berry 34,421
Medical compounds, certain named, Firm of E. Merck 34,420
Medicines, certain named, Columbia Drug Company 34,418
Medicines, certain named, T. H. Weaver 34,419
Overalls and blouse shirts, Scranton & Sheldon 34,400
Packing house products, certain named, Swift & Company 34,411
Papers, certain named, James R. Crompton & Brothers 34,398
Photographic supplies, certain named, American Photo Chemical and Manufacturing Company 34,399
Polish, metal, Fry & Davis 34,428
Pumps and engines, Geo. F. Blake Manufacturing Company 34,435
Rubber footwear, Hood Rubber Company 34,401
Shellac, Kilburn & Company 33,429
Shoes for ladies and children, Miller, Kohlhepp, Giese & Company 34,402
Spelter or slab zinc, New Jersey Zinc Company 34,441
Stoves, ranges, and furnaces, Rathbone, Sard & Company 34,434
Suppositories, C. K. Sober & Company 34,417
Telephone switchboards and appurtenances and telephones, Sterling Electric Company 34,432
Toilet articles, certain named, F. C. Fowler 34,422
Toilet articles, certain named, M. T. Rosenheim 34,424
Toilet preparations, certain named, C. M. Mallory 34,423
Tonic, nutritive, H. H. Tebault 34,415
Vaccine, Seabury & Roedel 34,416

LABELS.

"A. B. C. Baking Powder," for baking powder, Liquid Carbonic Acid Manufacturing Company 7,456
"Blue Maiden Hair Natural White Cherries," for canned goods, United States Printing Company 7,449
"Blue Ribbon Natural Peaches," for canned goods, United States Printing Company 7,452
"Blue Tripod Natural Bartlett Pears," for canned goods, United States Printing Company 7,448
"C. P. Bond's Improved Philadelphia Liniment," for a liniment, C. T. P. Bond 7,459
"Erberol," for an antiseptic fluid, L. G. B. Erb 7,461
"Geo. D. Insley & Son Celebrated Royal Brand Pure Crab Meat," for canned goods, G. D. Insley & Son 7,454
"Geo. D. Insley & Son Celebrated Royal Brand Pure Soft Shell Crabs," for canned goods, G. D. Insley & Son 7,453
"Golden Vine Natural Apricots," for canned goods, United States Printing Company 7,450
"Liquid Fruit," for soda water syrup, Liquid Carbon Acid Manufacturing Company 7,458
"Martha Washington Baking Powder," for baking powder, Liquid Carbonic Acid Manufacturing Company 7,457
"Practical Remedies," for a medicine, Boericke & Tafel 7,460
"Tartan Natural Select Lima Beans," for canned goods, United States Printing Company 7,451
"The Italian-American Macaroni Factory, Paste Finissime," for macaroni, A. De Franco 7,455

PRINTS.

"Cracker Jack," for confectionery, F. W. Ruckheim & Brother 217
"Yacht Back Congress Playing Cards," for playing cards, United States Playing Card Company 216

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 10 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York. Special rates will be given where a large number of copies are desired at one time.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

ESTERBROOK'S STEEL PENS

150 Varieties. For Sale by all Stationers.

Every Esterbrook Pen is warranted.

Works, Camden, N. J. THE ESTERBROOK STEEL PEN CO. 26 John St., New York.

IF YOU SHOOT A RIFLE, Pistol or Shotgun, you'll make a **Bull's Eye** by sending three 2c. stamps for the *Ideal Hand-book "A."* 126 pages **FREE.** The latest Encyclopedia of *Arms, Powders, Shot and Bullets.* Mention SCIENTIFIC AMERICAN. Address IDEAL MFG. CO., NEW HAVEN, CONN., U. S. A.

We Defy the World

to produce as good a wheel as the Arlington & Oakwood. Strictly high-grade, quality, material and construction unsurpassed. A marvel of beauty and strength, thoroughly tested and fully guaranteed. Shipped anywhere at lowest wholesale prices. Money refunded if not as represented. No money in advance.

$16.50

$35 "Arlington" $16.50
$40 "Arlington" $18.50
$50 "Oakwood" $21.50

We belong to no trust or combine—employ no agents. You pay but one small profit—and our enormous cash sales enable us to give the best value ever offered. Illustrated Catalogue Free. **CASH BUYERS' UNION, 162 W. Van Buren St., B-131, Chicago, Ills.**

50 YEARS' EXPERIENCE

PATENTS

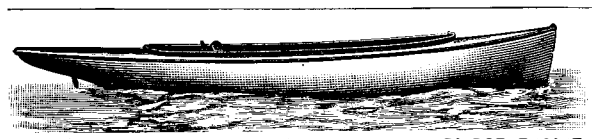
TRADE MARKS
DESIGNS
COPYRIGHTS &C.

Anyone sending a sketch and description may quickly ascertain our opinion free whether an invention is probably patentable. Communications strictly confidential. Handbook on Patents sent free. Oldest agency for securing patents. Patents taken through Munn & Co. receive *special notice*, without charge, in the

Scientific American.

A handsomely illustrated weekly. Largest circulation of any scientific journal. Terms, $3 a year; four months, $1. Sold by all newsdealers.

MUNN & Co. 361 Broadway, **New York**
Branch Office, 625 F St., Washington, D. C.



Prices $160 and up. Send for Catalogue.

PIERCE VAPOR LAUNCHES

Stock Sizes 14 to 22 foot.
Safe, Reliable and fully guaranteed.
PIERCE ENGINE CO., 17 N. 17th Street, Racine, Wis.

Ghost of the Glacier

And Other Tales, including Making a Revolution, Susquehanna Trail, Sculpture of the Elfs, Once a Pillar of the World, Feathers of Fashion, and others. A delightful volume, beautifully illustrated. Ready for distribution about May 1. Send 10 cents to T. W. Lee, General Passenger Agent, Lackawanna Railroad, 26 Exchange Place, New York City. Edition Limited.

LIGHT MANUFACTURING & EXPERIMENTAL WORK.
A—SHEET METAL STAMPING—PUNCHES & DIES.
AUTOMOBILES AND PARTS FOR SAME.
SPECIAL MACHINERY. INQUIRIES SOLICITED.
OTTO KONIGSLOW—45 MICHIGAN ST. CLEVELAND, O.

MAKE ICE CREAM IN 30 SECONDS
Best, purest, cheapest. No one cares to struggle with old time freezers after seeing the **Polar Star Freezer** making ice cream. Saves ice and salt, easily cleaned and operated, always in order.

☞ LIVE AGENTS WANTED.
Polar Star Mfg. Co., 281 Levant St., Philadelphia, Pa.

Floats for Steam Traps
Hercules Seamless Copper Floats are tested to 300 lbs. per sq. in. and warranted. The original and only genuine seamless copper floats made. Send for No. 2 Catalogue Free.
HERCULES FLOAT WORKS, Springfield, Mass.

THE PACIFIC AND ORIENTAL MAIL.

Leaves Grand Central Station, New York, by the New York Central, every night in the year at 9.15, and the fourth night thereafter this mail is at San Francisco, ready for delivery or transfer to the steamers for Hawaii, Australia, Philippines, Japan and China.

See the new "Round the World" folder just issued by the New York Central Lines.

A copy will be sent free, postpaid, on receipt of three cents in stamps, by George H. Daniels, General Passenger Agent, Grand Central Station, New York.

FOR SALE—at Low Price—the following list of Machinery—used but short time. 3 Baker Bros. Geared Drill Presses (joined). 2 3-Spindle Barnes Drill Presses. 2 Warner & Swasey Turret Lathes, 1 9-16 in. hole through spindle. 2 Warner & Swasey Turret Lathes, 2 3-16 in. hole through spindle. 1 12-in. Swing Pratt & Whitney Speed Lathe. 1 Small Profiling Machine—Garvin Machine Co. 1 Sprocket Milling Machine—Garvin Machine Co. 1 10-in. Swing Diamond Machine Co. Speed Lathe. 1 14-in. Swing Diamond Machine Co. Speed Lathe. 2 Pratt & Whitney Wheel Trueing Tables. 2 Wheel Lacing Tables. 2 Wheel Trueing Stands. 1 Rim Drilling Machine. 1 Pratt & Whitney Frame Drilling Machine. 1 Fox Machine Co. Tube Cutter. 1 Fox Machine Co. Rim Washer Press. 2 Diamond Machine Co. Belt Strapping Machines. 2 No. 3 Diamond Machine Co. Buffing Machine. 2 No. 2 Diamond Machine Co. Buffing Machines. 1 No. 5 Emery Wheel Grinder (double). 1 No. 3 Emery Wheel Grinder. 3 Gas Brazing Stands—complete. 1 Tube Brazing Furnace.
DUEBER WATCH CASE MFG. CO., CANTON, OHIO.

MODELS & GEARS CATALOGUE FREE. UNION MODEL WORKS 193 CLARK CHICAGO.

ICE MACHINES, Corliss Engines, Brewers' and Bottlers' Machinery. THE VILTER MFG. CO., 899 Clinton Street, Milwaukee, Wis.

THE RANSOM AUTOMATIC GAS MACHINE. Gas made from Gasoline. RANSOM GAS MACHINE CO., 371 E. Water St., Milwaukee, Wis.

Gasoline Engines—guaranteed reliable Generator valves in stock to replace carbureters any make engines one to six H. P., $5.00. Mianus Motor Works, Mianus, Conn.

TURBINES ☞ Send for Circular "M." JAS. LEFFEL & CO. Springfield, Ohio, U. S. A.

STEEL TYPEWRITER TYPE
TYPE WHEELS. MODELS & EXPERIMENTAL WORK. SMALL MACHINERY NOVELTIES & ETC. NEW YORK STENCIL WORKS 100 NASSAU ST. N.Y.

INVENTIONS PERFECTED.
Accurate Model and Tool Work. Write for Circular.
PARSELL & WEED, 129-131 West 31st St., New York.

... CORK SHAVINGS ....
O. HEROLD & CO.,
Lisbon, Portugal.

Experienced Draughtsmen wanted on mill machinery and machine tools. Permanent employment assured to rapid and accurate draughtsmen, Bethlehem Steel Co., So Bethlehem, Pa.

CALCIUM CARBIDE EXPORT COMP'Y,
35 NASSAU STREET, NEW YORK.
(A B C Code.) Cable Address: BRYAXE, NEW YORK.

GAS AND GASOLINE ENGINES
WATER MOTORS
BACKUS WATER MOTOR CO. NEWARK N. J. U. S. A.

MODELS & EXPERIMENTAL WORK. Inventions developed. Special Machinery.
E. V. Baillard, 106 Liberty St., New York.

NOVELTIES & PATENTED ARTICLES
Manufactured by Contract. Punching Dies, Special Machinery. E. Konigslow & Bro., 181 Seneca St., Cleveland, O.

GRINDING MILLS FOR ALL PURPOSES. Bogardus Patent Universal Eccentric Mill. Address J. S. & G. F. SIMPSON, 28 Rodney Street, Brooklyn, N. Y.

Experimental & Model Work
Cir. & advice free. Wm. Gardam & Son, 45-51 Rose St., N.Y.

Rare opportunity for a competent brass finisher. The plant and good-will of small manufactory of fine brass tubing and garden syringes of thirty-five years standing, for sale, owing to death of head of firm. Important to continue business without interruption. For sale outright or to be operated on shares.
Apply to E. W. DEAKIN, Ogontz, Penn.

MACHINERY WIPING TOWELS, sweat cloths, cheese cloth for dynamos, selected wiping rags, all kinds cotton cloth for manufactures. Silk towels, linen towels for shops. Very low prices. Correspond with GEORGE B. BROOKS, 268-270 Chalkstone Ave., Providence, R. I.

VOLNEY W. MASON & CO.,
Friction Pulleys, Clutches & Elevators
PROVIDENCE R. I.

D'AMOUR & LITTLEDALE MACHINE CO.
130 WORTH ST. NEW YORK.
Make Models of Any Machine to Order.

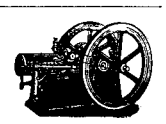
MANUFACTURE OF BICYCLES.—A very comprehensive article giving the details of construction of every part of these vehicles. With 15 engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. **908.** Price 10 cents. To be had at this office and from all newsdealers.

D. L. HOLDEN
1336 BEACH ST. PHILADELPHIA PA.
SOLE MANUFACTURER
REGEALED ICE MACHINES
SEE FIRST PAGE SCIENTIFIC AMERICAN SEPT. 2. 1899.

PEASE PAYS EXPENSES and $75 per month. Steady position; self-seller; no experience needed. Send 2c for contract. PEASE MFG. CO., Cincinnati, O., Dept. 10.

$3 a Day Sure Send us your address and we will show you how to make $3 a day absolutely sure; we furnish the work and teach you free; you work in the locality where you live. Send us your address and we will explain the business fully; remember we guarantee a clear profit of $3 for every day's work, absolutely sure, write at once.
ROYAL MANUFACTURING CO., Box 11, DETROIT, MICH.

FOOS GAS AND GASOLINE ENGINES 3 to 250 Horse Power.
Adapted for all power purposes.
Largest exclusive Gas Engine Factory in America. Established 1887.
Engines in stock for quick delivery in all principal cities.
Send for Illustrated Catalogue No. 5.
THE FOOS GAS ENGINE CO., Station A, Springfield, Ohio.



Inventors and Owners of Patents!

We have offices, selling agencies, and correspondents at every principal distributing point throughout the world; a large force of travelling men in the United States, in Great Britain, and Continental Europe; and over 300 corresponding buyers in foreign lands. We will accept sole selling agencies, or will buy patents for cash or royalty, on valuable machinery, hardware specialties, tools, etc. Correspondence solicited.

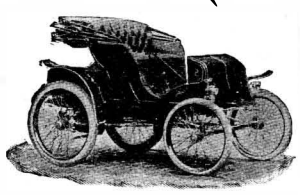
AMERICAN MACHINERY AND TRADING COMPANY,
MAIN OFFICE—Bowling Green Building, New York City.
BRANCHES—Chicago, Pittsburg, Philadelphia, Boston, Atlanta, St. Louis, San Francisco, Montreal, London, Paris, Berlin, St. Petersburg, Sydney.

THOROUGH INSPECTIONS AND INSURANCE AGAINST LOSS OR DAMAGE TO PROPERTY AND LOSS OF LIFE AND INJURY TO PERSONS CAUSED BY STEAM BOILER EXPLOSIONS

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO. HARTFORD, CONN.

J. M. ALLEN, PRESIDENT — W. B. FRANKLIN, VICE PRESIDENT
J. B. PIERCE, SECRETARY — F. B. ALLEN, 2D VICE PRESIDENT
L. B. BRAINERD, ASST TREAS. — L. F. MIDDLEBROOK, ASST SECY.

All Automobile Clubs



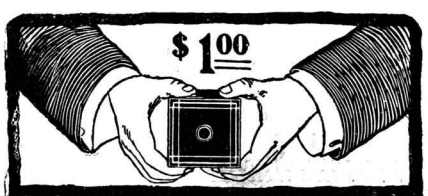
in America are familiar with the excellent points and durable qualities of the

WINTON MOTOR CARRIAGE

The swiftest, safest, simplest, handsomest and best of American made Automobiles. Speed can be regulated at will—even by a novice. Economical in cost and operation. No noise, no dirt, no danger. Hydro-carbon system. Simplicity itself.

Price $1,200. No Agents.

THE WINTON MOTOR CARRIAGE CO., Cleveland, Ohio.
Eastern Department, 120 Broadway, New York City.



Brownie Cameras

Make pictures 2¼ x 2¼ inches and load in daylight with our 6 exposure Film Cartridges. Fitted with fine Meniscus lenses and our improved rotary shutters for snap shots or time exposures. Strongly made, covered with imitation leather and have nickeled fittings. So simple they can be operated by any school boy or girl, yet will produce the best results.

THE PRICE.

Brownie Camera, for 2¼x2¼ pictures,	$1.00
Transparent Film Cartridge, 6 exposures 2¼ x 2¼,	.15
Paper-Film Cartridge, 6 exposures, 2¼ x 2¼,	.10
Brownie Developing and Printing Outfit,	.75

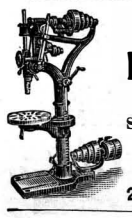
For sale by all Kodak dealers.

EASTMAN KODAK CO.

Brownie circulars and Kodak catalogue free at the dealers or by mail.

Rochester, N. Y.

GARDNER DIE STOCK
C. H. BESLY & CO. 1012 W. CANAL ST. CHICAGO ILL. U.S.A.
SEND FOR CATALOGUE



Drill Presses, Power Hack Saws,

Furniture and Bed Spring Machinery.
Special Machinery Built to Order.
Write for Catalogue.

HOEFER MFG. CO.,
275 Liberty St., Freeport, Ill., U. S. A.

OVER 25,000 IN USE.

EASILY PUT ON. HAS PROVED PERFECT AND RELIABLE. FULLY GUARANTEED.

Coasting becomes so safe and easy you do it every chance you get. Your feet on the pedals gives perfect control of the wheel. Ladies' skirts keep down when coasting. You can adjust it to any make of cycle.

Our **Acetylene Bicycle Lamp** is superior in construction to any made.

Illustrated pamphlet giving detailed information regarding Brake and Lamp, sent on application.

ECLIPSE BICYCLE CO.
Box X, ELMIRA, N. Y.

EACH PART OF A Columbia BICYCLE IS A MECHANICAL MASTER PIECE

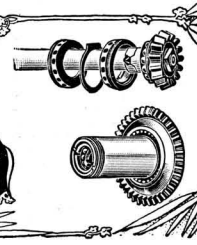
THE driving gear of the **COLUMBIA BEVEL-GEAR CHAINLESS** invites comparison with any any apparatus in which the combination of strength, lightness and certainty of correct action is sought for. The 1900 models are of greatly reduced weight and have many improvements throughout. Prices, Models 59 and 60, $60; Models 65 and 66, $75.

The new **COLUMBIA CHAIN WHEELS** have every improvement found in the Chainless models aside from the driving mechanism. Price $50.

HARTFORD, STORMER and **PENNANT** bicycles combine durability, mechanical simplicity and excellence of manufacture. Prices $35, $30 and $25.

The **COLUMBIA COASTER BRAKE** saves one-third of the pedaling necessary in ordinary riding, and does not twist and strain the driving wheel.

See Columbia and Stormer Catalogues.



AMERICAN BICYCLE COMPANY
POPE SALES DEPARTMENT
HARTFORD CONN.

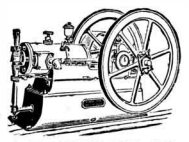
Ladies' Watches

All styles and sizes are shown in our Blue Book — Free.

NEW ENGLAND WATCH CO.
37 Maiden Lane, N.Y.
149 State St., Chicago.

CHARTER Gasoline Engine

USED ANY PLACE BY ANYONE FOR ANY PURPOSE



Stationaries, Portables, Engines and Pumps.

☞ State your Power Needs.

CHARTER GAS ENGINE CO., Box 148, STERLING, ILL.

JESSOP'S STEEL THE VERY BEST FOR TOOLS, SAWS ETC.
WM JESSOP & SONS LTD 91 JOHN ST. NEW YORK

SPEED SAFETY COMFORT

CAPE NOME, CAPE YORK, ST. MICHAEL, DAWSON

AND ALL POINTS ON THE YUKON RIVER

DIRECT.

Operating ITS OWN Fleet of First-Class Ocean Steamships

ST. PAUL, PORTLAND, BERTHA, RAINIER, DORA and others.

Full Line of River Steamers on the Yukon.

Under contract to deliver United States Mails throughout the Territory.

First Departure, APRIL 30th, and Fortnightly thereafter.

For new Folders, Maps and further particulars as to Freight and Passage, write to

ALASKA COMMERCIAL COMPANY,
310 SANSOME STREET, SAN FRANCISCO, CAL., for all particulars.

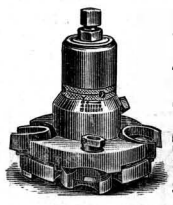
Ninety per cent of the CAPE NOME GOLD output will be dredged out and saved by

KROGH'S CENTRIFUGAL SAND PUMPS

and **Drake's Amalgamators.** The only machines that have stood the most exacting tests of practical miners.

KROGH MANUFACTURING CO. 9 to 17 Stevenson St., San Francisco. Patentees and Builders.

In daily operation at the works. Builders of modern **MINING, DRAINING** and **IRRIGATION MACHINERY** of highest efficiency. ☞ Send for Descriptive Catalogue.



5 CENTS A DAY pays for the use of

The Shimer Cutter Heads

To match 12,000 ft. of 4 in. strips (board measure) single tongue and groove—the most economical Cutter Head in all the world. Send for Catalogue, No. 22. Address

S. J. SHIMER & SONS, Milton, Pa.

Acetylene Burners.

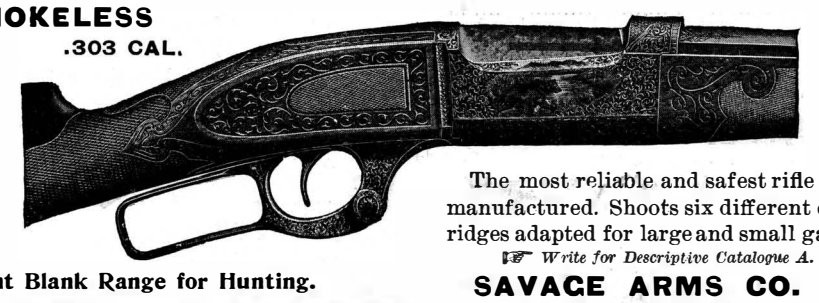
Samples, ¼ to 1 foot, 25c. each.
A new burner for **STEREOPTICONS.** Highest C. P. possible.
State Line Talc Co., Chattanooga, Tenn.

DEFIANCE MACHINE WORKS
DEFIANCE, OHIO, U.S.A.
BUILDERS OF HUB, SPOKE, WHEEL, BENDING, WAGON, CARRIAGE AND HOOP MACHINERY.
LONDON OFFICE, 16 ELDON STR. E.C.
SEND FOR CATALOGUE.

Scales All varieties at lowest prices. Best Railroad Track and Wagon or Stock Scales made. Also 1000 useful articles, including Sates Sewing Machines, Bicycles, Tools, etc. Save Money. Lists Free. CHICAGO SCALE CO., Chicago, Ill.

SAVAGE Hammerless Magazine Rifle

SMOKELESS .303 CAL.



The most reliable and safest rifle ever manufactured. Shoots six different cartridges adapted for large and small game.

☞ *Write for Descriptive Catalogue A.*

SAVAGE ARMS CO.
UTICA, NEW YORK, U. S. A.

Point Blank Range for Hunting.
The Only Hammerless Repeating Rifle.

LATHES Foot Power, High Grade

W. P. Davis Mach. Co., Rochester, N.Y.

ASBESTOS FIRE-FELT COVERINGS
PURE ASBESTOS. ABSOLUTELY FIRE PROOF.
REPLETE WITH AIR CELLS. PERFECT NON-CONDUCTORS.
STRONG, LIGHT, FLEXIBLE. EASILY APPLIED.
MADE IN SECTIONS THREE FEET LONG.
FIT STANDARD PIPE ½ INCH TO 16 INCHES.
H. W. JOHNS MFG CO.
NEW YORK · CHICAGO · PHILADELPHIA · BOSTON · MAKERS OF
ASBESTOS MATERIALS. LIQUID PAINTS & STAINS.
ROOFING MATERIALS. ELECTRICAL MATERIALS.

"PEGAMOID" TRADE MARK

ALUMINUM PAINT.

Latest application of Aluminum. Looks like Frosted Silver. Washable. Untarnishable, Water, Oil and Weatherproof. Durable. Easily Applied. Bicycles, Yachts, Radiators, Pipes, Metal Work, Machinery, Dynamos, Motors, Apparatus, Arc Lamps, Sockets, Brackets, Cars, Stations, General Decoration, etc. Sample bottle, by mail, for 25 cents.

THE AMERICAN PEGAMOID CO., 339 B'way, New York.

A way to change your work

YOU can prepare yourself for a better position without neglecting your present work. Our students advance in salary and position *while studying*. More than 150,000 students and graduates have taken technical courses by mail. No need to leave home or sacrifice present salary. Our own copyrighted texts are furnished free. Your success is guaranteed.

Others Have Raised Themselves.

Devote part of your leisure time to the study of **Mechanical or Architectural Draughting, Electrical, Mechanical, Steam or Civil Engineering; Architecture, Surveying, Mining, Chemistry, Bookkeeping and Stenography BY MAIL.**

Established 1891. Capital $1,500,000. Write and tell us what profession you wish to enter.

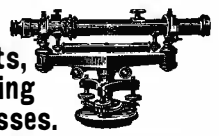
The International Correspondence Schools, Box 943 Scranton, Pa.

Instruments of Precision

for **ARCHITECTS, ENGINEERS** and **SURVEYORS.**

We are manufacturers of

Levels, Transits, Surveying Compasses.



Through many years experience we have so improved our Surveying Instruments, that they are pronounced to be the best instruments made. We guarantee accuracy and workmanship.

☞ *Write for our lavishly illustrated catalogue.*

KEUFFEL & ESSER CO., 127 Fulton St., New York

BRANCHES:
111 Madison St., CHICAGO. 708 Locust St., ST. LOUIS.

The Greatest Photographic Offer EVER MADE!

NEHRING'S

Set of

CONVERTIBLE AMPLISCOPES

Put up in a neat case containing:

1 Copying and Enlarging Lens,
1 Portrait Lens,
1 Wide Angle Lens,
1 Tele Photo Lens,
1 Orthochromatic Ray Screen.

These Lenses can be used with any camera made fitted with a rectilinear or anastigmat lens.

Price, per set, containing the above Lenses: **4 x 5—$5.00; 5 x 7—$6.00.** The above lenses can also be had singly at $2.00 each in the 4x5 and at $2.25 each in the 5x7. Special prices will be quoted on larger sizes.

U. NEHRING, Dept. S, 16 E. 42d St., N. Y.

A Safe Housekeeper

is our Hammerless

Sold by...
Hardware, Sporting Goods and General Stores.
Catalogue S for the asking.

HARRINGTON & RICHARDSON ARMS CO., Worcester, Mass.

PRINTING INKS

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

PERFORATED METALS OF EVERY DESCRIPTION BY THE HARRINGTON & KING PERFORATING CO. 225 N. UNION ST. CHICAGO